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ASTM BULLETIN

APRIL 1954

Number 197

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IN THE SOCIETY

GENERAL NEWS NOTES

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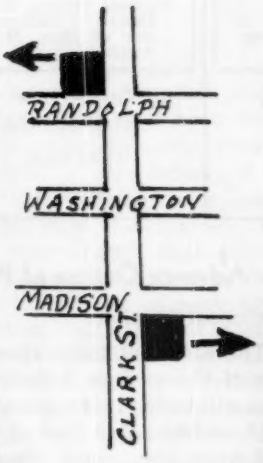
ASTM BULLETIN

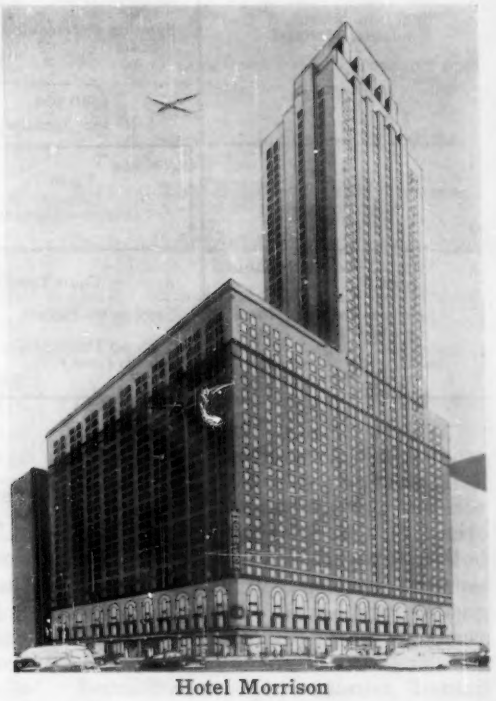
"Promotion of Knowledge of Materials of Engineering, and Standardization of Specifications and Methods of Testing"

Number 197 APRIL, 1954

Advance Outline—57th Annual Meeting Chicago, June 13—18

Hotel Sherman





Hotel Morrison

THE following outline of the 57th Annual Meeting is presented to enable our members to begin to make plans for attending the meeting. The Chicago Committee on Arrangements is making every effort to have this one of the most outstanding meetings in the history of the Society.

Meetings in Two Hotels

Most of the technical sessions will be held at the Sherman as well as the Exhibit of Testing Apparatus and Laboratory Supplies, the Photographic Exhibit, and committee meetings. A few of the technical sessions and many of the 600 committee meetings will be scheduled at the Morrison Hotel. ASTM registration desks will be placed at both hotels so that those who find most of their committee meetings at one hotel and secure room reservations there may register for the meetings without any delay.

Entertainment—Ladies Please Note

In view of what definitely will be a most intensive series of committee meetings and technical sessions, the Chicago Committee on Arrangements is planning to provide entertainment features at intervals throughout the week so that our members will have opportunity to take advantage of many of them. The highlights of the entertainment will be the Annual Dinner to be held on Wednesday evening. For the past several years the ASTM dinner has become increasingly popular with our members and the Chicago Committee hopes that the 1954 dinner will be an attraction for all ASTM members attending the meeting.

The local committee is making every effort to make the stay of the ladies in Chicago one that they will long remember. With the increasing number of ladies accompanying their husbands to an Annual Meeting of the Society, it is quite evident that the attractive entertainment programs that have been developed for recent meetings are appreciated.

Hotel Reservation Forms

The official hotel reservation form will be mailed to all members and committee members around April 10. At that time the various committees will have approved their meeting schedule. Meeting rooms can then be assigned at the two hotels. This will enable our members to determine where they should like to secure sleeping room accommodations and also the number of days they wish to attend the meeting. Members are requested to await the arrival of this reservation form in

ADVANCE TENTATIVE OUTLINE OF FIFTY-SEVENTH ANNUAL MEETING

	MONDAY, June 14	TUESDAY, June 15	WEDNESDAY, June 16	THURSDAY, June 17	FRIDAY, June 18
Morning	Opening Session—Testing	Chicago Sponsored Session on Specifications	Session on Fatigue *(cont.)* Session on Soils	Sym. on Cyclic Heating and Stressing Metals	Sym. on Building Constructions *(cont.)* Session on Plastics Session on Impact Testing
	11:30 a.m. Report Sessions	11:30 a.m. Report Sessions	11:30 a.m. Report Sessions	11:30 a.m. Report Sessions	11:30 a.m. Report Sessions
Afternoon	Sym. on Coal Sampling Sym. on Electrical Insulating Material	12:00 noon Luncheon Session—President's Address, Awards Sym. on Odor Sym. on Permeability of Soils	Session on Fatigue *(cont.)* Session on Significance of Tests of Concrete	Sym. on Cyclic Heating and Stressing Metals *(cont.)*	
	4:30 p.m. Report Sessions	4:30 p.m. Report Sessions	4:30 p.m. Marburg Lecture, H. F. Dodge — Interpretation of Data, Medal Awards	4:30 p.m. Report Sessions	
Evening	Sym. on Coal Sampling *(cont.)* Sym. on Electrical Insulating Material *(cont.)* Session on Bituminous and Road Materials	Sym. on Odor *(cont.)* Session on Fatigue Sym. on Permeability of Soils *(cont.)*	Cocktail Party ASTM DINNER Floor Show Dancing	Session on Creep Sym. on Building Constructions Session on Concrete	

order to avoid changes in reservations if it becomes evident that one hotel will be more convenient than the other. The sleeping room facilities at both hotels are alike, and this year we are most fortunate in having a far greater number of sleeping rooms available to our members than at any previous Annual Meeting. A limited number of air-conditioned sleeping rooms is available at both hotels.

LADIES PROGRAM INCLUDES

***Coffee hour—everyday**
***Entertainment—Lucille LaChapelle "You Are Better Than You Sound"**
***Don McNeill's Breakfast Club (Radio and T-V Broadcast)**
President's Luncheon
****Luncheon and Puppet Opera—Kungsholm Restaurant and Theater**
***Tommy Bartlett's "Welcome Travelers" (Radio and T-V Broadcast)**
†ASTM Dinner-Dance
****Luncheon and Style Show—Chez Paree**
†Sightseeing Tours

* Free to all ladies registered.
** Token Fee.
† Partially subsidized by Local Committee.

Advance Outline of Program

Technical Sessions

The attached table shows an outline of the various technical sessions that will be held throughout the week. It should be noted that at 11:30 a.m. and 4:30 p.m. short report sessions are being planned for the presentation of reports of committees. A complete Provisional Program, with abstracts of all technical papers, will be included in the May ASTM BULLETIN which will go in the mails early in May. The following symposiums will feature the technical sessions:

Symposium on Coal Sampling (Monday afternoon and evening)

Symposium on Electrical Insulating Material (Monday afternoon and evening)

Symposium on Permeability of Soils (Tuesday afternoon and evening)

Symposium on Odor (Tuesday afternoon and evening)

Symposium on Cyclic Effect of Heating and Stressing on Metals (Thursday morning and afternoon)

Symposium on Building Constructions (Thursday evening and Friday morning)

Luncheons, Dinners, and Lectures

President's Luncheon (Tuesday Noon)

The President's Luncheon will again provide the occasion for the President's Address and presentation of various recognitions and awards. Holding such an event at a luncheon session has worked out most successfully in enabling our busy members to attend.

Gillett Lecture (Tuesday afternoon)

ASTM Past President R. L. Templin, Director of Research and Chief Engineer of Tests, Aluminum Company of America, will present the third H. W. Gillett Memorial Lecture on the subject "Fatigue Properties of Aluminum."

This lecture—first presented at the Fiftieth Anniversary Meeting of the ASTM in 1952—is jointly sponsored by the American Society for Testing Materials and Battelle Memorial Institute and commemorates Horace W. Gillett, the first Director of Battelle, and one of America's leading technologists and

ASTM DINNER-DANCE

Cocktail Hour—"Dutch Treat"
***Dinner "Delux"**
***Floor Show**
***Dancing till 1 a.m.**

* Partially subsidized by Local Committee.

metallurgists. Its scope covers subjects pertaining to the development, testing, evaluation, and application of metals.

Marburg Lecture (Wednesday afternoon)

Howard F. Dodge, Bell Telephone Laboratories, chairman of ASTM Committee E-11 on Quality Control, will present the twenty-eighth Edgar Marburg Lecture. Mr. Dodge, long recognized as a pioneer and leader in the field of statistics and quality control, will speak on "Interpretation of Scientific and Engineering Data."

This lecture originated as a memorial to the first Secretary of the Society and was established to emphasize the importance of furthering knowledge of properties and tests of engineering materials.

ASTM Annual Dinner (Wednesday evening)

The Chicago Committee on Arrangements is rapidly rounding out details for the 1954 Annual ASTM Dinner. The committee is accepting the challenge of previous years and is making every effort to have its dinner even better than those preceding it. The increasing interest shown in this Annual Meeting feature confirms the feeling that the reinstatement of an Annual Meeting Dinner has been an asset to the enjoyment of the meeting, providing the members with another spot during the week where they may relax with their fellow members of ASTM. Complete details of the dinner and other features will be outlined in the May BULLETIN.

Report Sessions

As mentioned above, provision is made in the morning and afternoon of each day for Report Sessions where committees can present their reports to the Society following their committee meeting. The committee reports to be presented at each of the sessions will be outlined in the table which will accompany the hotel reservation form and will also appear in the Provisional Program in the May BULLETIN.

Committee Meetings

All of the committees which have indicated that they will meet during the Annual Meeting of the Society are now being canvassed for confirmation of the days when they will meet. The following committees have indicated their intention to meet. Beside each committee we are indicating in parenthesis the meeting time being suggested to each committee. (It should be remembered that official notice of committee meetings will come from the officers of each committee and that final plans for attending these meetings should be made in accordance with advice received directly from them). The table accompanying the hotel reservation form, which will go in the mails around April 10, will show a tentative plan of committee meetings, and will indicate in which hotel each meeting will be held.

One of the sights of Chicago—Buckingham Fountain in Grant Park.

A-1 on Steel—Monday, Tuesday, Wednesday
A-2 on Wrought Iron—Thursday
A-3 on Cast Iron—Thursday, Friday
A-5 on Corrosion of Iron and Steel—Monday, Tuesday
A-6 on Magnetic Properties—Monday
A-7 on Malleable-Iron Castings—Friday
A-9 on Ferro-Alloys—Tuesday
A-10 on Iron-Chromium Alloys—Wednesday, Thursday
B-2 on Non-Ferrous Metals—Monday, Tuesday
B-3 on Corrosion of Non-Ferrous Metals—Wednesday
B-5 on Copper—Wednesday, Thursday
B-6 on Die-Cast Metals—Wednesday
B-7 on Light Metals, Cast and Wrought—Tuesday
C-1 on Cement—Monday, Tuesday
C-4 on Clay Pipe—Monday, Tuesday
C-7 on Lime—Wednesday, Thursday
C-9 on Concrete—Thursday, Friday
C-11 on Gypsum—Tuesday
C-12 on Mortars for Unit Masonry—Thursday, Friday
C-15 on Manufactured Masonry Units—Monday, Tuesday
C-17 on Asbestos-Cement Products—Monday
C-20 on Acoustical Materials—Monday, Tuesday
D-1 on Paint, Varnish, Lacquers—Monday, Tuesday, Wednesday
D-2 on Petroleum Products—Sunday, Monday, Tuesday, Wednesday, Thursday, Friday
D-3 on Gaseous Fuels—Monday, Tuesday
D-4 on Road and Paving Materials—Monday, Tuesday
D-5 on Coal and Coke—Monday, Tuesday
D-6 on Paper and Paper Products—Wednesday
D-8 on Bituminous Waterproofing and Roofing Materials—Wednesday, Thursday, Friday
D-9 on Electrical Insulating Materials—Tuesday, Wednesday
D-11 on Rubber—Wednesday, Thursday, Friday
D-16 on Industrial Aromatic Hydrocarbons—Monday, Tuesday
D-17 on Naval Stores—Wednesday, Thursday
D-18 on Soils for Engineering Purposes—Monday, Tuesday, Wednesday
D-19 on Industrial Water—Wednesday, Thursday, Friday
D-20 on Plastics—Thursday, Friday
D-22 on Methods of Atmospheric Sampling and Analysis—Monday, Tuesday
E-1 on Methods of Testing—Monday, Tuesday, Wednesday
E-2 on Emission Spectroscopy—Wednesday, Thursday
E-3 on Chemical Analysis of Metals—Monday, Tuesday, Wednesday
E-4 on Metallography—Monday, Tuesday
E-5 on Fire Tests of Materials and Construction—Monday, Tuesday, Wednesday
E-6 on Methods of Testing Building Constructions—Thursday, Friday
E-7 on Non-Destructive Testing—Tuesday, Wednesday
E-9 on Fatigue—Tuesday
E-10 on Radioactive Isotopes—Thursday
E-11 on Quality Control of Materials—Wednesday
E-12 on Appearance—Thursday, Friday

Preprint Request Blank

The usual preprint request blank will be placed in the mails about April 16. This blank will contain a list of all committee reports and technical papers that will be available for preprinting. It is planned to mail the first installment of preprints about May 7, the second installment, May 21, and the third installment, June 5. Every member is urged to return his preprint blank as promptly as possible.

NEW ASTM PUBLICATIONS

X-Ray Diffraction Cards—a Growing Proposition

THE X-Ray Diffraction card file, compiled by the Joint Committe on Chemical Analysis by Powder Diffraction Methods, under the joint auspices of the American Crystallographic Assn., American Society for Testing Materials, the British Institute of Physics, and the National Association of Corrosion Engineers, contains data for the identification of materials by the Hanawalt X-Ray Diffraction Method. It consists of five sections which may be used separately or combined. Sections 1, 2, and 3 consist of approximately 1300 cards each, and Sections 4 and 5 each contain approximately 700 cards.

Data may be obtained either on plain cards (3 by 5 in.), on Keysort cards (4 by 6 in.) or on standard IBM cards. The Keysort cards have the Keysort coding around their border with holes punched but not notch coded. Instructions for coding are supplied with the cards.

	Plain Cards	Keysort Cards	IBM Cards
Section 1....	$135.00	$185.00	...
Section 2....	135.00	185.00	$120.00
Section 3....	135.00	185.00	...
Section 4....	90.00	120.00	30.00
Section 5....	90.00	120.00	30.00

The above prices for *plain* and *Keysort* cards apply to the first deck of cards. Additional decks for building three card per compound files of Sections 1, 2, and 3 can be obtained at $50 per deck per section for the plain cards and $70 per deck per section for Keysort cards. Likewise additional decks of Sections 4 or 5 can be obtained at $35 per deck per section for plain cards and $50 per deck per section for Keysort cards. The prices quoted for IBM cards are for three card per compound files. A 700-page index book is supplied free of charge to purchasers of any portion of the plain or Keysort cards. It may also be purchased separately for $10.

These cards contain numerical values for the powder pattern lines, with intensities (cards arranged according to the "d" values of the three strongest lines). Lattice constants, space group, etc., are included where available.

Sections 1, 2, and 3 contain data collected from industry, literature, and laboratories, under the direction of W. P. Davey of The Pennsylvania State University, editor of the card file, and issued on the present format in 1949. Dr. Davey's staff working on the card file consists of A. S. Beward (acting as assistant editor), Prof. Gustave Cohen, and Miss Joan Hepler.

Sufficient funds were collected from the sale of these data to establish a Research Associateship at the National Bureau of Standards in 1949, which has been continued to the present. The present Research Associate is Mrs. Nancy T. Gilfrich, who works under the direction of Dr. H. F. McMurdie of the Bureau of Standards staff. Duties of the Research Associate include a review of conflicting data in the card file and a selection of the correct pattern or preparation of new patterns of standard material when required. The results of this work are included in Sections 4 and 5 of the card file. Section 4 was issued in 1952 and Section 5 in 1953.

In 1953 sufficient funds had accumulated to add three associate editors for the card file. These are G. W. Brindley, The Pennsylvania State University; Benjamin Post, Polytechnic Institute of Brooklyn; and Sigmund Weissman, Rutgers University. These associate editors will review the data going into the card file, promote submittal of new data, and stimulate work by other laboratories. Dr. Brindley will specialize in minerals, Dr. Post in inorganic and organic substances, and Dr. Weissman in metals and alloys. This will relieve Dr. Davey so that he can devote more time to coordinating over-all publication of the data with his staff at Penn State.

Further details on the card file can be obtained by writing to ASTM, 1916 Race St., Philadelphia 3, Pa.

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Plastics Compilation Issued

PROVIDING in convenient form the over 100 specifications and tests developed by the Society through the intensive work of its Committees D-20 on Plastics, and D-9 on Electrical Insulating Materials, this 680-page compilation is of widespread interest because of the rapidly accelerating use of plastics in a variety of ways. Both the producer and user find this book an important source of valuable data.

Specifications cover the various families of plastics—phenolics, cellulose, ureas, vinyls, etc. Tests involve bond strength, brittleness, density, diffusion, flammability, haze, mar resistance, stiffness, etc. Several standards on nomenclature and definitions are included. Price: $5.25; to ASTM members, $4.

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Bituminous Materials Supplement

THE new Supplement contains all the revisions and editorial changes concerning the standards included in the third edition of the compilation on Bituminous Materials for Highway Construction, Waterproofing, and Roofing. It brings up to date this widely used compilation issued early last year.

The third edition includes the various standard and tentative specifications of terms pertaining to bituminous materials used in highway construction and in waterproofing and roofing. This publication is sponsored by Committee D-4 on Road and Paving Materials and Committee D-8 on Bituminous Waterproofing and Roofing Materials. Included are those standards covering creosote materials which are under the jurisdiction of Committee D-7 on Wood, but of direct interest to the highway construction field. There are about 100 specifications and methods of testing, in their latest approved form. 368 pages. Price: $2.65.

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Reference Radiographs—Aluminum and Magnesium Castings

REFERENCE radiographs, approved for publication by the Society at the Annual Meeting under the ASTM Designation E 98 - 53 T, are now available. They illustrate various types and degrees of discontinuities occurring in aluminum and magnesium castings. They also include a concise numerical system for designating the discontinuities based on the Tentative Industrial Radiographic Inspection of Castings and Weldments (ASTM Designation: E 52).

The reference radiographs have been reproduced from the Bureau of Aeronautics Reference Radiographs dated August 1, 1951, through the courtesy of the Navy Department, Bureau of Aeronautics. They were selected from a large number of radiographs of aircraft castings accumulated over a period of years, and are considered to be highly representative of the discontinuities frequently found in aluminum and magnesium castings. The set consists of 62 negatives covering aluminum castings and 45 negatives covering magnesium castings. Price: $110.

February Actions of ASTM Administrative Committee on Standards

Thermal and Electrical Insulating Materials and Methods of Testing Committees Propose New Methods and Revisions

ON FEBRUARY 23, 1954, the Administrative Committee on Standards gave its approval to recommendations from three of the ASTM committees for additions to and changes in standards published by the Society. Methods and specifications involved in these actions are listed in the accompanying box and summarized briefly below.

Thermal Insulating Materials

Committee C-16 received approval of a new Tentative Method of Test for Thermal Conductivity of Pipe Insulation (C 335) which provides a procedure for determining the thermal conductivity of pipe insulation at mean temperatures between approximately 50 and 500 F.

In revising Tentative Method of Test for Thermal Conductance of Transmittance of Built-up Sections by Means of the Guarded Hot-Box (C 236), the committee has completely rewritten the method to bring it in line with current improved practice. As opposed to the Guarded Hot Plate Method (C 177) which is primarily concerned with homogeneous samples, the Guarded Hot-Box method is designed for measurements on non-homogeneous panels representative of such constructions as wall, roofs, and floors of a building.

Electrical Insulating Materials

Tentative Specifications for Electrical Insulating Paper, Interlayer Type (1168–54 T) represent the culmination of a part of a study begun in 1947 by Committee D-9 looking toward the formulation of specifications on electrical insulating paper to meet requests of electrical and electronic equipment manufacturers. These specifications cover electrical grade unsized, unbleached sulfate papers for use as interlayer insulation in coils, transformers, and similar apparatus. Tissue for the manufacture of capacitors is not included in these specifications.

Committee D-9 has also revised Tentative Methods of Testing Hydrocarbon Waxes Used for Electrical Insulation (D 1168), incorporating some of the changes and suggestions made during letter ballot of the committee on acceptance of this method in 1950.

These changes include the addition of the ASTM Tentative Method of Test for Kinematic Viscosity (D 445) under Methods of Test, Paragraph 2 (*e*) Viscosity. Explanatory notes have also been added as the result of experience of Subcommittee VI on Solid Filling and Treating Compounds, with the various tests; and several existing paragraphs have been clarified by editorial revision.

Methods of Testing

Subcommittee 9 on Rheological Properties of Committee E-1 developed Tentative Method of Test for Saybolt Furol Viscosity of Asphaltic Materials at High Temperatures (E 102) in response to a request from Committees D-4 on Road and Paving Materials and D-8 on Bituminous Waterproofing and Roofing Materials for a test procedure for determining viscosity of asphaltic materials at temperatures of 250, 300, 350, 400, and 450 F. This method, which was urgently needed, represents the results of cooperative laboratory tests carried on over a period of about three years.

Preparation of the above method necessitated tentative revision by Subcommittee 17 on Thermometers of Standard Specifications for ASTM Thermometers (E 1) to incorporate detailed specifications providing purchase requirements for five thermometers called for in the above Method E 102.

New Cleveland Engineering Center

EXEMPLIFYING the growth and importance of engineering in the industrial northeastern Ohio area, a $1,378,000 building and development program for the construction of a new downtown Engineering Center has been announced by the Cleveland Engineering Society.

To be known as the Cleveland Engineering Center, the two-story structure will be of contemporary design and will provide facilities aimed at making it the focal point of all engineering activities in northeastern Ohio. Providing a sharp contrast in design, size, and facilities, the modern building will replace the CES headquarters at 2136 E. 19th St. Some 36,000 sq ft of space will be provided in the new center. It will have an auditorium seating 950 people and dining rooms equipped to serve 400 people. Preliminary architectural sketches prepared by Garfield, Harris, Robinson, and Schafer, Cleveland architects, show unusual designs for meeting, conference, and classrooms, administrative offices, and industrial exhibit space. Escalators will operate between the main lobby and the auditorium, while freight elevators will bring industrial equipment to the auditorium stage level.

Actions Taken by Administrative Committee on Standards February 23, 1954

New Tentatives

Methods of:

Test for Saybolt Furol Viscosity of Asphaltic Materials at High Temperatures (E 102 – 54 T)

Test for Thermal Conductivity of Pipe Insulation (C 335 – 54 T)

Specifications for:

Electrical Insulating Paper, Interlayer Type (1168 – 54 T)

Revisions of Tentatives

Methods of:

Test for Thermal Conductance and Transmittance of Built-up Sections by Means of the Guarded Hot-Box (C 236 – 54 T)

Testing Hydrocarbon Waxes Used for Electrical Insulation (D 1168 – 54 T)

Specifications for:

ASTM Thermometers (E 1 – 54 T)

The Department of Defense

By Charles S. Thomas,

Assistant Secretary of Defense

Activities of the Department of Defense are of interest to many of our members. Because of the responsibilities given the Assistant Secretary for Supply and Logistics concerning Standardization, his talk at Committee Week Dinner seems particularly pertinent to our readers with special emphasis on standardization activities.

It is needless for me to tell you what a tremendous contribution your profession has made to industry and the great contribution your association has made in standardizing the component parts of modern-day equipment and production. I suppose the first recognition in American industry of the vital role played by interchangeability of components was in the small arms development of Eli Whitney inventor of the cotton gin. From this point on, the necessity for standard equipment, standard techniques of measurement, and standards of raw material quality played an ever increasing part in the industrial process.

When your association was formed in 1902, America was already on its way to be the industrial leader of the world. Today, with perhaps one-twentieth of the world's population, we are able to produce about one-half of the world's manufactured products. As far as this organization is concerned, it must be gratifying to know that a large measure of this industrial capacity is attributable to the profession and general application of scientifically developed standards, the sort of standards your association has been sponsoring for the last half-century.

But I am not going to talk to you about your particular field. Not only is it a highly specialized field but as you well know, I am not an expert in it. Rather, I am going to tell you something about the present Department of Defense, and particularly about my office, the Assistant Secretary of Defense for Supply and Logistics.

You, as citizens, have a tremendous stake in the Department of Defense because it has the primary responsibility for the defense of your country, and because it is spending close to ¾ of every one of your tax dollars. And probably it will continue to spend the greater part of your tax dollar because there is no indication whatsoever that there can be anything else but a condition of world tension for many years to come. You will therefore be particularly interested in the future programs of the Department of Defense because their success, or their failure, will have a great impact both on the security and economy of our country.

I am first going to tell you about the present Department of Defense organization. I will then tell you of some of the problems which confront this organization, and finally I will tell you what some of our programs are to solve these problems.

The top echelon of the Department of Defense is the Office of the Secretary of Defense, which has the responsibility of making the policies for and coordinating the activities of the four military services.

The late James Forrestal, who was Secretary of the Navy before he was Secretary of Defense, originally conceived the Office of the Secretary of Defense. He envisioned it as a small policy-making and coordinating office, to make policies for the four services—the Army, the Navy, the Air Force, and the Marine Corps—and coordinate their activities. Under no conditions was it to get into their operations. Also, originally it was conceived to be staffed by about 100 people. However, it was extended far beyond its original concept and purpose and, when this Administration came into office there were not 100 people in the Office of the Secretary of Defense but 3103. With that many people, it had developed into an entirely different organization than had been originally planned.

With that background, let's take a look at the new set-up of Office of the Secretary of Defense as it is today.

Under Reorganization Plan No. 6, recently enacted by the Congress, the Department of Defense now has a Secretary, a Deputy Secretary, and nine Assistant Secretaries. This has been referred to by one critic as a "huge superstructure" and by another as "a monolithic theory of organization carried to its ultimate state." It so happens both of these critics were uninformed as exactly the opposite happens to be the fact. The trend in the Office of the Secretary of Defense and, as a matter of fact, the other Government agencies, and under President Eisenhower's direct order, is toward *decentralization*. The military services are too vast to operate centrally. Their operations have to be decentralized and that is now in the process of being done.

Charles S. Thomas speaking at ASTM Dinner

The nine Assistant Secretaries—or vice-presidents if you please, are, in my opinion, the minimum number capable of carrying out the vast responsibilities of this office. As you well know, many of our banks and large industrial organizations have more than that number of senior executive officers and yet they are only a fraction of the size of the Department of Defense.

To give you an idea of how the Assistant Secretaries will operate—and each one's duties are in specialized fields—let's take my own office as an example, the Assistant Secretary of Defense for Supply and Logistics. Incidentally the word "logistics" means simply, that branch of the military art which em-

braces all the details of the transporting, quartering, and supplying of troops. It runs the gamut of these services for our forces and armies all over the world. It's big business on a scale never before known.

My charter assigns to my office the following responsibilities: "developing policies and procedures for the Department of Defense in the broad fields of procurement, production, distribution, transportation, storage, cataloging, requirements, and mobilization planning." These responsibilities are to a very large extent those which were assigned to the old Munitions Board, which was abolished by the last Congress. The Munitions Board on June 30, 1952, a year and a half ago, had approximately 650 people on its payroll to carry out its intended duties of policy-making. Our new office has been set up with an entirely new organization which will have only 145 people to carry out the same policy-making functions. I can, therefore, assure you that my office is not working toward centralization but rather toward decentralization—decentralization with the proper coordination at the top level. It is becoming, as it should be, a policy-making office, delegating the operations to the four services.

The problems which confront the Department of Defense, and the services, are varied and vast, and I think I can best give them to you by citing a few figures.

In 1935, and this is important to remember, the total appropriation of the Army, Navy, and Marine Corps—there was no Air Force then—was a little more than a half billion dollars—actually it was only 590 million dollars. A short time later these same services had appropriated to them from 1942 through 1945 approximately 300 billion dollars. In other words, in that short period, they spent more than 500 times as much as they spent in the year 1935.

Let me give you one particular example of this tremendous expansion. In 1944, when we were starting to mount our great offensive in the Pacific, I was sent by Mr. Forrestal to the Naval Supply Depot in Oakland, Calif. This depot was loaded with critical items but they were 90 days behind in their paper work. The material was there all right but they didn't know it or wouldn't be able to use it for 90 days. Now think of this. The entire Naval appropriation in 1936 was only 350 million dollars. That was for personnel, maintenance, ships, aircraft—everything. Now then, at this one Naval Supply Depot, a short time later there was 426 million dollars of inventory—75 million dollars more in inventory in that one supply depot than the entire Naval appropriation had been a short time before (incidentally, there is now over a billion dollars in this same depot)—and this is only one of the Navy's many supply depots, and it does not include those of any of the other three services.

Ask yourself what would happen if your business should double in any one year. Then ask yourself what would happen if it increased, not 500 times, but 20 or 30 times in a short period—the answer to that is patent. You would be fraught with tremendous difficulties and would make many mistakes—it would be very costly to you. So I ask, could any organization expand as fast as the services have been forced to expand and build a supply system to absorb such an expansion of materials and technical items and not make a lot of mistakes? Of course not, and it was inevitable that after having expended the 300 billion dollars in such a short time in the last war, there were bound to be surpluses and excesses at the end, and there were. But let's not fool ourselves—war is that kind of a wasteful operation and none of us yet knows the answer to this vital problem.

Then let's also remember that after World War II instead of an orderly demobilization, the demand was made by Congress and the mothers and fathers, to bring the boys home—and right now—and we did just that. We let out of the services those who had been trained to carry this heavy supply and logistics load. On top of that, we then started the heavy cuts and the paring to the bone of the defense program. No sooner had that been done than along came Korea and another 170 billion dollars was pumped into the supply system. Again it became a race to spend money, and because of our unpreparedness, the same mistakes had to be, and were, made all over again.

Now we, as practical businessmen, all know that you cannot plan well and spend efficiently that much money in that short a time. So I challenge anyone to show how our services can be subjected to such peaks and valleys and rapid acceleration and deceleration and be expected to do a good planning and an economical procurement job.

We might as well realize that the services are now entirely different services than they were prior to World War II. They are the biggest business in the world with budgets of 35 to 40 billion dollars annually, or 80 to 90 times as large as they used to be. And as I said before, spending close to $\frac{3}{4}$ of every one of the taxpayers dollars, the public, via the Congress, is going to demand competency in military spending. As all of you know, Congressional committees have been and are becoming increasingly active in reviewing the activities of the Defense Department, and properly so when we consider the astronomical size of our Defense appropriations. My office is, therefore, charged with the responsibility of developing the over-all policies for an efficient supply and logistics system that will, insofar as possible, enable the services to handle efficiently this tremendcusly expanded work load.

How is my office approaching this policy-making and coordinating job? Frankly, we are doing it with people. It makes no difference how good an organization chart you have or how good a program you have unless you have competent people to carry it out.

First of all, in the Defense Department there are two of the most competent people it has ever been my privilege to know—Mr. Wilson and Mr. Kyes. Both men have been successful in everthing they have ever done—and they have made great personal sacrifices to come to Washington to serve their country. But what I like equally well is that they are used to large organizations. Large business is not new to Mr. Wilson. His former company has done over 7 billion dollars a year for the last three years. He and Mr. Kyes are used to dealing in large volumes and modern systems, and best of all they are planners. They are used to making a long range plan and adhering as close to that plan as current conditions will permit—but there always is a plan, and a good one.

They are doing just that now. They have a well laid out long-term basic plan for the military services so that whatever amount of money the Congress appropriates to the services will be spent on a programmed basis rather than on a feast and famine basis.

As to my office, I have solicited the aid of industry on the basis that my assignment cannot possibly be fulfilled unless industry is willing to lend us their top specialists in these highly specialized fields.

I first selected as my deputy, Thomas P. Pike of Los Angeles, president of the Pike Drilling Co. He is an outstanding citizen, 44 years old, who, in his own right, has built a very large and prosperous business. From the standpoint of his own interest, this is the worst time for him to leave his business, but despite that, he has come here as my full-time Deputy.

Warren Webster, 52 years old, has left the presidency of his large and prosperous business, the Warren Webster Manufacturing Co. of Camden, N. J., to head our Procurement and Production Policies Office.

Distinguished guests and ASTM officers assembled at head table to hear Assistant Secretary of Defense C. S. Thomas speak at Committee Week dinner, are left to right: J. R. Dwyer, National Bureau of Standards, and Secretary, Washington District Council; Commander W. H. Howe, Chairman, Navy Standardization Committee, U. S. Navy; R. E. Hess, ASTM Associate Executive Secretary; Colonel W. W. Milner, Chief, Standards Branch, Procurement Division, Department of the Army; F. T. Hague, Director, Aircraft and Marine Craft, Office of Assistant Secretary of Defense; E. W. Baumann, National Slag Assn. and Chairman of Arrangements Committee of Washington District; Captain C. A. Blick, Head of Materials Control Division, Office of Naval Material, Department of the Navy; A. V. Astin, Director, National Bureau of Standards; N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric Corp., Philadelphia, and ASTM Senior Vice President; Assistant Secretary of Defense, C. S.

Earl B. Smith, 57 years old, vice-president in charge of all transportation at General Mills in Minneapolis, has also been lent to us for two years to head our Transportation and Communications Office.

Roger F. Hepenstal, 51 years old, vice-president in charge of all production of the American Can Co. of New York, has likewise been lent to us to head the Cataloging, Standardization, and Inspection Office.

Robert C. Lanphier, 50 years old, vice-president of Sangamo Electric Co. of Springfield, Ill., heads our Planning and Review Office.

As you can see, these are all men of outstanding and recognized ability. They are men at their peak and there is not a political appointee among them. If we can't do this job for our country with this type of citizen, then I don't know how it can be done.

As to some of our specific programs, I will outline but a few of them. First, Mr. Wilson has formed recently, a committee to standardize the fiscal and accounting procedures among the four services. The services have not had this before and it will be a great step forward. It will give financial accountability along with management responsibility, something which is greatly needed.

Second, we are now developing an effective industrial mobilization plan. It appears that we are in for a long-drawn-out cold war and we are going to have to limit our defense spending to an amount that we can afford and keep our economy sound. In this respect we are particularly fortunate because our nation's industry is of such vitality that it is not only maintaining a war economy but also the highest civilian economy in the history of the world and is still over-producing in many fields. If we should turn this entire production capacity to military production overnight, the results in my opinion would be staggering. Therefore it becomes important that we prepare in advance to take advantage of this production capacity, and this is being done in two ways.

We are carefully analyzing mobilization requirements of major items to see if it is feasible to produce these items both as to quantities required and within the time required. We are then allocating, in advance, certain of these items to certain plants and have these plants ready to start production the day war may start. In this way there will be no lag in defense production.

Third, industrial funds are being established in the services as rapidly as possible. Heretofore, most of the services' industrial plants such as shipyards, ordnance plants, powder factories, research laboratories, and the like were financed by allotments under appropriations. The financing was not directly related to total production, and cost data on products were sketchy and generally inaccurate. There was very little basis for comparison of similar operations in private industry and, as a matter of fact, within the services themselves. Under the industrial fund, each activity is given a capital fund to finance the cost of its operation. These costs are accumulated against the end product and the finished goods are sold to the using activity on the basis of actual cost. Whenever we introduce one of these funds into an operation, we immediately have an improvement in cost control. The industrial managers are required to devote close attention to their production costs, and we are then enabled to make some comparison between our operations within the services and with those of private industry.

Fourth, we are working toward completion of a standard catalog for all the services. At the present, each service has its own cataloging system and, as near as we can estimate, there are approximately 4½ million different catalog numbers involved. We find many cases where one individual item will have up to 400 different stock numbers. The new standard catalog, by screening alone, should purify these numbers to something around 2,000,000 items. This will not only result in interchangeability but in less inventory and greater turnover—all necessary ingredients for any successful operation. Many people think of the new catalog as a heavy, thick and glorified telephone book. The catalog, covering ships spare parts alone is a series of volumes about 10 ft

Thomas; E. F. Kelley, Bureau of Public Roads, and Chairman, ASTM Washington District Council; L. C. Beard, Jr., Assistant Director, Socony-Vacuum Laboratories, and ASTM President; E. F. Mansure, Administrator, General Services Administration; D. A. Quarles, Assistant Secretary of Defense for Research and Development; R. J. Painter, ASTM Executive Secretary; Colonel B. Cornett, Chief, Domestic Standards, Directorate of Requirements, Department of the Air Force; Clifton E. Mack, Commissioner, Federal Supply Service, General Services Administration; E. H. Weaver, Assistant Director of Materials, Office of Defense Mobilization; W. S. McLeod, Director, Standards Division, General Services Administration; Fred Burggraf, Director, Highway Research Board, National Research Council, and Vice-Chairman, ASTM Washington District Council.

long. This cataloging program in itself is indeed a prodigious undertaking.

Fifth, and to my mind, most important of all, we are pursuing diligently a standardization program. This will result in fewer items, fewer parts, and also in greatly reduced inventories.

I have just returned from a three-week trip to Japan and Korea and saw there first-hand the great need for such standardization. For example, this program has already resulted in the decrease in the number of different bearings from 74,000 to 21,000. It has decreased the number of different electron tubes from 5000 to 192 which have now been standardized. The parts in the ¼ in. internal combustion engines have been reduced from 1189 to 57 and finally, and even I can understand this, it has decreased the number of different types of screw drivers from 800 to less than 100.

Sixth, the problem of surplus property—there is a great accumulation of obsolete and excess materials in our military system. Certainly there is no use in storing this type of material, and, at the same time, building more warehouses for new materials. Most of this material came from World War II in the form of obsolete airplanes, weapons, spare parts, and the like, via the crash and rapidly expanded programs which I mentioned before. In any event, we have a progressive program called "Clean Sweep" and are in the process of disposing of this obsolete and excess material to the best advantage in order to clean up the military supply system.

There are many other things the present Department of Defense is doing to establish modern policies, procedures, and techniques for coordinating and standardizing the operations of all four of the services, and all of these will make for a better defense program and for more defense for the taxpayer's dollar.

In conclusion I should like to tell you what I think of our military leaders and the men who are such an important part in this program. They are, by and large, outstandingly able men. For the most part, they are men who would have been successful in your business or any business enterprise they might have entered, but they chose the military services and accepted the monetary sacrifices that go with it because of the life and venturesome nature of the services—and frankly, the services do have much color and many compensations.

These military leaders recognize that their services have now become of age, that they are the largest business in the world, and they are going to continue so. They also know they have to have—and they themselves want—modern supply, fiscal, and accounting systems, and the Defense Department is in the process of giving them those modern systems. Incidentally, this should result in giving you, as citizens, more defense for your dollar—a sounder long-range program; and it should help maintain a sound economy and monetary structure which we must have if we are not to lose a war before we have even started to fight.

I have found nothing but complete cooperation within the services, and the desire of all hands to get the job done. I believe that you as citizens have an outstanding team in the Defense Department, the Army, the Navy, the Air Force, and the Marine Corps, and as for myself, I am tremendously proud to be a part of that team.

The contributions of the nation's basic and applied research to the civilian economy are important in the maintenance and preservation of the free society that has evolved under our ... system of democracy. If the social and economic structure of a society provides its people with a good life, with not too great a variation in its quality from the bottom to the top of its structure and accompanies this with a reasonable amount of leisure for all, the overwhelming majority of the members of that society are then content with it as a framework within which to live.

—Mervin J. Kelly, *President*, Bell Telephone Laboratories

ASTM Bulletin

APRIL, 1954

NO. 197

NINETEEN-SIXTEEN
RACE STREET
PHILADELPHIA 3, PENNA.

President's Welcome

ASTM President Dr. Leslie C. Beard, Jr., in welcoming members and guests who attended Committee Week dinner in Washington, spoke as follows:

It is pleasant to be with you here in Washington. I am conscious of an atmosphere of constructive businesslike planning and of confidence in the future. It is a tribute to us to have present representatives of Government who are contributing to this favorable environment. We, in science and industry, need a climate of reason, untrammeled with needless obstacles, so that we may fully devote our efforts to constructive accomplishment. There are assembled here this week 1400 committeemen dedicated to just such tasks.

Undoubtedly, during this week you will hear from representatives of Government of the need for new and better materials of all kinds; for new methods of testing or specifying the same. We should welcome such assignments. The severe demands of military equipment tax materials far beyond the conditions imposed by civilian demands. These tasks are a challenge to our ingenuity and, further, the solution of these problems today will serve us well in solving the civilian needs some years hence. If the past be a guide, the demands of the military today will be those of civilians tomorrow. Heat-resistant materials for gas turbines or jets, 115/145 aviation gasoline, and lubricants that will function over wide temperature ranges are just a few examples of things where skills gained early, in working with the military, are paying-off in civilian applications.

Government, on its part, is dedicated to a policy of using industry specifications and tests where these can be used to an advantage. This will permit Government use of materials already in production with the advantages of ready availability and favorable costs.

A clear recognition of our mutual responsibilities will help us build an impregnable defense and a strong industrial economy.

I wish you all a pleasant and constructive week and may you leave here with the feeling that it has been worth while.

THE SOCIETY APPOINTS...

MYRON PARK DAVIS to ASA Safety Standards Board.

J. H. FOOTE to ASA Electrical Standards Board.

F. L. MARSH to represent Committee C-11 on Gypsum to ASA Sectional Committee A 42 on Specifications for Plastering.

H. M. SMITH to ASA Sectional Committee Z-11 on Petroleum Products and Lubricants, succeeding T. A. BOYD.

H. R. WOLF to ASA Sectional Committee Z-26 on Safety Glass, succeeding H. C. MOUGEY.

J. J. KANTER to the Joint Committee on Definitions of Terms Relating to Heat Treatment, succeeding T. S. FULLER.

FRANCIS SCOFIELD to Inter-Society Color Council, succeeding W. C. GRANVILLE.

W. D. APPEL as ASTM representative on Committee on AATC Perkin Centennial.

NEXT MONTH—

The complete provisional program of the Annual Meeting, June 13–18, will appear in the next issue of the BULLETIN scheduled to reach you early in May

Schedule of ASTM Meetings

This gives the latest information available at ASTM Headquarters. Direct mail notices of all district and committee meetings customarily distributed by the officers of the respective groups should be the final source of information on dates and locations of meetings. This schedule does not attempt to list all meetings of smaller sections and subgroups.

DATE	GROUP	PLACE
April 6	Committee E-1 on Methods of Testing	Phila., Pa. Headquarters
April 7–9	Committee D-14 on Adhesives	Pittsburgh, Pa. (Mellon Institute)
April 8–9	Committee D-10 on Shipping Containers	Atlantic City, N. J. (Claridge Hotel)
April 12–13	Committee B-1 on Wires for Electrical Conductors	New York, N. Y. ASA Headquarters
April 13	New York District—Joint Meeting with TAPPI	New York, N. Y. (Fraunces Tavern)
April 22	New England District Meeting	Storrs, Conn.
April 23	Philadelphia Section NACE Governing Board	Phila., Pa. ASTM Headquarters
May 11	Committee E-11 on Quality Control of Materials	Phila., Pa. (Benjamin Franklin Hotel)
May 13–14	Committee C-20 on Acoustical Materials	Madison, Wis. (Edgewater Hotel)
May 24–26	Committee E-14 on Mass Spectroscopy	New Orleans, La. (Hotel Jung)
June 13–18	**ASTM Annual Meeting (Eleventh Exhibit of Testing and Scientific Apparatus and Laboratory Supplies and Ninth Technical Photographic Exhibit)**	**Chicago, Ill. (Sherman and Morrison Hotels)**

Non-Destructive Testing at Joint Philadelphia Meeting

ALTHOUGH there may have been some momentary disappointment on the part of some of those attending the Philadelphia District Meeting on January 27, due to the inability of Dr. McMaster to be present, this was readily dispelled by the able presentation by Sam Wenk. Mr. Wenk, Chief Non-Destructive Testing Division, Battelle Memorial Inst. and Assistant to Dr. McMaster, presented his subject of "Non-Destructive Testing" before more than 100 members and friends of ASTM and the Society for Non-Destructive Testing at the Poor Richard Club.

Non-destructive testing has become a vital operation in modern industrial production and quality control. Proper application lowers production costs and increases industrial productivity. Misuse or omission of appropriate non-destructive tests on critical structures or equipment is sometimes disastrous.

Mr. Wenk analyzed present non-destructive test methods, their basic principles, uses and limitations, and the trends in future developments. The various methods he discussed included X-ray type penetrants, blacklite, and magnetic induction.

The coffee speaker, who followed the excellent filet mignon dinner served by the Poor Richard Club, was Marvin R. Halbert, Assistant District Attorney of Philadelphia County, who spoke on "A Day With the D.A." Mr. Halbert outlined a typical day in one of the city courts closing with a suggestion that it is not only the privilege but probably should be the duty of each citizen to make it a point to attend a court session.

1954 Industrial Health Conference

MORE than 100 specialists in different phases of industrial hygiene will speak before the meeting of the American Industrial Hygiene Assn., which will be held April 26 to 29, as a part of the 1954 Industrial Health Conference; at the Hotel Sherman in Chicago.

High point of the meeting will come Wednesday and Thursday, when concurrent sessions will touch on over 50 different aspects of air pollution, chemistry and analysis, engineering, radiation, and toxicology. Experts in these fields will share their knowledge with the hygienists.

ACR Notes

Printed on behalf of the Administrative Committee on Research.

Why a column in the ASTM BULLETIN devoted to research? A brief recapitulation of ASTM history may serve as justification.

The ASTM developed from the American Section of the International Association of Testing Materials which was formally organized in 1895 at Zurich with all European countries, except Turkey, and the United States represented. The object of the IATM as stated in its statutes, was, "the development and unification of standard methods of testing for the determination of the properties of the materials of construction and of other materials, and also the perfection of apparatus for that purpose."

The American Section of the IATM was organized in June of 1898 and it is interesting to note that at the second annual meeting of the Section in 1899 contributions of $200 were made as the nucleus of a Fund for Publication and *Research*.

Signs of disunity in the IATM became evident when Professor Mansfield Merriman of Lehigh University, Chairman of the American Section, spoke before the third annual meeting of the American group in 1900. Some of his comments were: "It may here be plainly stated that the policy of the International Association in regard to publications is not satisfactory to many American members. The proceedings of the Council meetings are not published, no financial statements are given out, and practically nothing is known of the work of the technical committees. . . . The reform that I would advocate is one suggested by the experience of the American Section, which now issues bulletins, giving the reports of the committees, the proceedings of the meetings, and regular quarterly statements of receipts and expenditures."

The American Society for Testing Materials was formally established through the granting of a charter on June 3, 1902, under the laws of the Commonwealth of Pennsylvania. Charles B. Dudley, a chemist with the Pennsylvania Railroad in Altoona, Pa., was elected as the first President of the new organization—total membership, 175. The scope of the ASTM was defined as *"The promotion of knowledge of the materials of engineering and the standardization of specifications and the methods of testing."* President Dudley in his first annual address to the Society expressed it this way: "The valuable specification represents the function of the studies of those who make investigation into the properties of useful materials . . . ."

Thirty years ago, at the 1924 Annual Meeting in Atlantic City, Committee E-9 on Correlation of Research (now Administrative Committee on Research) was organized "to devise ways and means by which that function of the Society defined as 'Promotion of knowledge of engineering materials' may be advanced."

ASTM President T. S. Fuller in his address, "Some Gratifying Results," presented on the occasion of the Fiftieth Anniversary Meeting in 1952, pointed up the necessity of research when he said: "As new materials become available and as the complexity of the information required by the engineering profession increases, so let the philosophy of testing change to keep abreast of the demands. Two phases, namely, the evaluation of materials and the control of quality, are involved in the science of testing. The evaluation of the properties of materials requires research and development programs which may extend over considerable periods of time."

Research is of little value unless it is effectually disseminated among individuals having similar interests. This is done through committee reports and the publication of technical papers. To inform ASTM members, as well as those outside the Society, specifically of the many ramifications of research as undertaken by the technical committees, the Administrative Committee on Research has published at intervals the "Review of ASTM Research." These reviews summarizing the major research activities of the technical committees were published in 1940, 1943, and 1947. The most recent edition published in the December, 1952, and January and February, 1953, BULLETINS, was reprinted and more than 1500 copies already have been distributed. This latest issue references more than 325 research projects actively engaged in by the technical committees. Many requests were received for copies of this article as a result of mention in various journals of its availability.

An analysis of the sources of these requests will be made in a future column.

"Some Unsolved Problems," collated and distributed by the ACR, includes research problems on which various committees would like to see work undertaken. These problems are such that due either to lack of funds, facilities, personnel, or combinations of these three, the committees are unable to study them. "Some Unsolved Problems" has been mailed to all the accredited science and engineering schools in this country and Canada and to some 900 industrial and research laboratories in this country.

Several hundred replies have been received as a result of this distribution, and it is hoped that "ACR Notes" may serve as a center for the publication of pertinent letters, exchange of ideas, possible sources of new work for committees, and in general as a clearing house for research items of general interest to ASTM. Contributions and comments concerning "ACR Notes" will be welcome and should be addressed to the Secretary, Administrative Committee on Research, ASTM Headquarters, 1916 Race St., Phila. 3, Pa.

Complimentary copies of the "Review of Research" or "Some Unsolved Problems" also may be obtained from Headquarters.

Technical Committee Notes

Activities of the ASTM technical committees which met in Washington during the Society's largest Committee Week, February 1–5, are summarized on these pages. For convenience, other committee meetings held recently in other cities are also included in this report. *For further news of ASTM Committee Week, please turn to page 10.*

A-1 Steel

Over 175 members and guests attended the series of meetings of Committee A-1 in Pittsburgh on January 25, 26, and 27. The meetings were well attended and during the three-day session many new standardization projects were reported by the numerous subcommittees, sections, and other participating groups.

C. T. Edgerton has resigned as chairman of Subcommittee IV on Spring Steel and Steel Springs, and T. R. Weber of the American Locomotive Co., Railway Spring Division, has been named as his successor. Mr. Edgerton was elected as an honorary member of Committee A-1 in view of his long and eminent service.

Mechanical Testing.—The Tentative Methods and Definitions for the Mechanical Testing of Steel Products (A 370) were approved for publication by the Society at the 1953 Annual Meeting. A description of special tests applicable to bolting has been approved for letter ballot of Committee A-1. If approved for publication by the Society, it will be added to Tentative Methods A 370. Subcommittee XIII on Methods of Testing is also conducting an investigation of impact testing to determine its usefulness and reproducibility in testing steel products.

Steel Rails and Accessories.—The American Railway Engineering Assn. is considering changes in its specifications for steel rails. Action was taken to keep ASTM Specification A 1 in harmony with the AREA recommendations. ASTM tentative specifications for accessories such as joint bars, track and screw spikes, track plates, and track bolts and nuts (A 2, A 3, A 4, A 5, A 65, A 66, A 67, A 76, and A 241) were recommended for adoption as standard.

Structural.—Committee A-1 has approved proposed tentative specifications for structural steel for welding, and it is expected these will be published under an ASTM designation in the near future. The Subcommittee on Structural Steel also recommended the adoption as standard of Tentative Specifications A 8, A 94, A 113, A 283, and A 328.

Forgings.—The Subcommittee on Forgings proposed in Specifications A 292, A 293, and A 294 for generator rotors, turbine rotors, and turbine wheels, that in addition to the present yield strengths measured at 0.02 per cent offset, provision be made for specified yield strengths at 0.2 per cent offset. It was also recommended that Tentative Specifications A 236, A 237, A 243, A 266, A 289, A 290, and A 317 be adopted as standard.

Pipe and Tubing.—The tables of chemical requirements in all the tubular products specifications will be changed to eliminate dual tables showing ladle and check analysis and a single table covering the ranges now shown as check analysis will be substituted. A proposed specification for high-strength electric fusion welded pipe for gas lines is under way, as well as a proposed specification for forged and bored austenitic steel pipe for central station use. In Tentative Specification A 106 for Seamless Carbon-Steel Pipe for High-Temperature Service it is recommended that a new grade C be added with a 70,000 psi tensile strength and a 40,000 psi yield point.

Plates for Pressure Vessels.—The Subcommittee on Pressure Vessel Plate recommended a revision of the impact test requirements in Specifications A 300 covering plates for low-temperature service. Changing the maximum carbon content for grade B chromium-molybdenum steel plate in Specification A 301 from 0.21 to 0.17 per cent is under consideration.

Bar Steels.—Subcommittee XV on Bar Steels is actively engaged in restyling all the bar steel specifications, using the principle of a general requirement specification as has been done with the structural specifications and the pressure vessel specifications. A proposed guide for the selection of bar compositions according to section size is being written, based on hardness properties at section locations specified in Army Ordnance Specification MIL-S-11451A.

Sheet Steel.—Now in final stages for subcommittee approval are proposed specifications for low-alloy high tensile strength hot-rolled sheets and for low-alloy high tensile strength cold-rolled sheets. For a number of years Subcommittee XIX has had under consideration a specification for flange and firebox quality sheets, but agreement on requirements has been lacking. It has been decided to ask the Boiler Code Committee of the ASME what requirements are considered essential by consumers.

Bolting.—The development of specifications for transmission tower bolts and for structural rivets has been assigned to Subcommittee XXVI. Work is well under way on transmission tower bolts. In Specifications A 194 for high-temperature service nuts a new grade 6 covering type 416 stainless steel is under consideration.

Castings.—It is recommended that grade WCA be dropped from Specification A 216 for Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service, also that the chemical composition and hydrostatic test requirements for grade WCB be modified.

A-3 Cast Iron

Committee A-3 held a series of meetings February 3 and 4. The meetings of four subcommittees brought forth a considerable amount of discussion and constructive action. The properties of nodular iron and cast iron at low and elevated temperatures were the subject of a great part of the discussion. Specifications A 43 for Pig Iron were recommended for adoption as standard after a minor editorial change.

Producers and consumers were much in accord in regard to upgrading the specifications for the annealed grade of nodular iron in Specifications A 339. The 60–45–10 grade specifying 10 per cent elongation was recommended to be changed to 60–45–15 with 15 per cent elongation. Manufacturing techniques have improved to the extent that a higher quality of material is consistently being produced for this relatively new iron. Although there was discussion about the possibility of including some high-strength heat-treated grades of nodular iron in the specifications, the majority felt that there was insufficient interest to warrant considering specifications for such a product at this time.

The subcommittee meetings on Research and Elevated Temperature Properties of Cast Iron were well attended and active interest shown in the investigation being conducted at the Southern Research Institute under the auspices of

the ASME-ASTM Joint Committee on Effect of Temperature on the Properties of Metals.

The first step of the project at Southern Research Institute was to determine the softening temperature for a number of class 40, 50, and 60 irons and from such information, select irons for elevated temperature tests. Chairman Vanick requested anyone having irons suitable for elevated temperature applications to send test bars to Southern Research Institute for consideration in the program. Another committee was obtaining data relative to upper limit of temperature for stress relieving cast iron as there was considerable evidence to show that the maximum limit specified in Specification A 278 could in many cases be safely exceeded.

The first meeting of a newly formed subcommittee on the low-temperature properties of cast iron was held. Most of the interest in low temperature properties of metals lies in the impact strength. Although the impact strength of cast iron is low in comparison with that of ductile metals, it has nevertheless proved very satisfactory in compressors and similar equipment down to −100 F. Investigations showed that the impact strength of cast iron will drop about 25 per cent from room temperature to −100 F. Although many felt that specifications for cast iron for low-temperature applications would be desirable, more data are needed and these would be considered at the next meeting.

A-5 Corrosion of Iron and Steel

Committee A-5 acted on several standards, three new tentatives being submitted to letter ballot of the committee, one a specification for zinc coating (hot dip) on fabricated or assembled steel products, and the other two recommended practices for safeguarding against warpage and distortion during hot-dip galvanizing of steel assemblies and for safeguarding against inferior galvanized coatings. Subject to concurrent action of Committee B-8 on Electrodeposited Metallic Coatings, the committee voted, subject to letter ballot, to adopt Specification A 219, Methods of Test for Local Thickness of Electrodeposited Coatings as standard. Tentative drafts of specifications for armor wire and for poultry netting are currently under consideration. In view of current work and pending revisions, Specifications A 122, Zinc-Coated Steel Wire Strand ("Galvanized" and Class A ("Extra Galvanized")), A 218, Zinc-Coated Steel Wire Strand (Class B and Class C Coatings), A 337, Zinc-Coated Iron or Steel Chain-Link Fence Fabric Galvanized Before Weaving, and A 363, Zinc-Coated Steel Overhead Ground Wire Strand are being retained in the tentative status.

Also currently out to letter ballot of the committee are revisions in A 112 for Zinc-Coated (Galvanized) Iron or Steel Tie Wires to include cut lengths and to replace the present twist test with a wrap test.

The negative votes submitted in response to the letter ballot of a year ago on the subject of the deletion of the Preece test method for thickness of zinc coating in A 122 and A 218 were reconsidered by the appropriate subcommittee and the main committee and it was agreed to submit the recommendations concerning the Preece test to the Society for approval.

Consideration was given to the comments given by the liaison man at the Santa Cruz, Calif., test site, who suggested that in view of the distance from the ocean and the elevation of the site it does not seem to be truly marine. It was agreed that in the future this site should be classified as "rural (marine)."

The meeting of Subcommittee XVI on Hardware Tests saw crystallized the program for a new series of atmospheric tests on various types of hardware. As a result of questionnaires sent to the membership of Committee A-5 and also to the Edison Electric Institute, 30 replies were received supporting the desirability of formulating such a new program. Exposures will be made at New York City and Kure Beach, N. C. Specimens to be included in the program are flats, unthreaded rods, and flats with a cold bend made before coating. The basis materials will be carbon steel and three alloy steels. Coatings to be included are hot-dip zinc, hot-dip aluminum, and electroplated zinc.

A-7 Malleable-Iron Castings

Approval was given to data on malleable iron for inclusion in the Symposium on Metallic Materials at Low Temperatures to be published by the Society.

Following presentation of evidence of regular use of Specification for Malleable Iron Flanges, Pipe Fittings and Valve Parts for Heavy Duty Use (A 338) the committee voted to adopt this Specification as standard, subject to letter ballot approval of the entire committee.

Possible revision of A 220 Specification for Pearlitic Malleable Iron Castings was considered and provision made for further review.

Chairman W. A. Kennedy presented the results of round bar impact tests of malleable iron, pearlitic malleable, and other ferrous materials. These provided an added indication of the excellent low-temperature impact properties of the high-strength, high-ductility type of malleable iron.

A-10 Iron-Chromium, Iron-Chromium-Nickel

The recommended practice for passivation and cleaning of stainless steel equipment is currently out to letter ballot of Committee A-10 and upon acceptance will be sent to the Society for its approval. A draft of a recommended practice for the acid copper-sulfate test is under consideration within the committee as is the oxalic acid etch test as an alternate procedure to the present boiling nitric acid test (A 262).

The extensive program of stainless steel specimens which are to be subjected to atmospheric exposure is currently nearing completion with the help of the AISI, which group is assisting in the procurement of the various steels. A series of tests on eight grades of stainless steel was initiated last year at Pittsburgh and New York, the object of this particular test being to compare 17 per cent chromium with 18 per cent chromium - 8 per cent nickel steels.

In ASTM Tentative Specifications A 297, Heat-Resistant Iron-Chromium and Iron-Chromium-Nickel Alloy Castings for General Application, the chromium and nickel ranges for the HF alloy have been modified to narrow the range for chromium from 18 to 23 to 19 to 23 per cent and for nickel from 8 to 12 to 9 to 12 per cent. Specification A 167, Corrosion-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip and A 177 for High-Strength Corrosion-Resisting Chromium-Nickel Steel Sheet and Strip are being studied with the thought of including AISI tolerances and type numbers.

Subcommittee XII on Specifications for High-Temperature, Super-Strength Alloys has completed a special compilation of chemical compositions and rupture properties of super-strength alloys. This has been submitted to the committee for comment, and this report together with comments is expected to serve as a basis for specifications for (*a*) precipitation hardening, (*b*) hot-cold worked, and (*c*) cast superstrength alloys.

Subject to confirming letter ballot, the committee voted to continue Emergency Alternate Specifications EA 167, EA 240, and EA 276 which permit the

use of a columbium-tantalum combination in addition to straight columbium in the columbium-modified steels. In view of the expectation that the unavailability of virtually pure columbium will continue, it was agreed that the respective subcommittees should give thought to including these three EA modifications in the respective ASTM standards.

B-3 Corrosion of Non-Ferrous Metals

The Salt Spray Test (B 117) has long been under discussion not only in Committee B-3 but in many other technical committees of the Society as well as within non-ASTM groups. As a result of extensive cooperative tests within Subcommittee III on Spray Test, a recommendation will be submitted to letter ballot of the committee recommending that the present 20 per cent salt solution be replaced by a 5 per cent solution. In addition, a new tentative will be proposed embodying the acetic acid modification of the salt spray test.

The specimens removed from atmospheric test racks after 20-yr exposure have been cleaned and are now being weighed for determination of weight loss.

The spool-type specimens of the magnesium galvanic couple program have been exposed and evaluated and a report is currently being prepared covering this part of the program. The first of three sets of the disk-type couples was removed last year and the weight loss data are currently being evaluated. There has been some discussion as to the type of specimen to be used for the plate type specimens, and to aid in this decision a limited number of samples are currently being run. These samples have been on exposure for several months and they will be examined within the next few months to determine whether corrosion has progressed far enough to make them usable as guides in selecting the type of panel for the program.

As it has been eight years since the committee sponsored its last symposium, the "Symposium on Atmospheric Exposure Tests on Non-Ferrous Metals," a similar symposium is being planned for the ASTM Annual Meeting, June, 1955.

B-7 Light Metals and Alloys

The light metals industry being relatively young in comparison with the other metals fields, Committee B-7 has found numerous revisions needed in the various standards developed for these materials. In Specifications B 108 for Aluminum-Base Alloy Permanent Mold Castings, the tensile strength and yield strength requirements for alloy SC122A have been increased. Also in B 108 and in B 26 on Aluminum-Base Alloy Sand Castings melting ranges for ZG42A and ZG32A have been narrowed, the latter having been changed from 1020–1175 F to 1105–1180 F. In Specifications B 211 for Aluminum and Aluminum-Alloy Bars, Rods, and Wire, action is being taken to delete alloy CM-41B as it is no longer commercially produced. Addition of new alloys is under consideration including that of GS11C to B 241, Aluminum-Alloy Pipe, and study is being given to the desirability of including forging stock requirements in B 247, Aluminum-Alloy Die Forgings. ASTM Tentative B 90 for Magnesium-Base Alloy Sheet will probably be expanded to include plate material as well as the present magnesium sheet. In view of pending revisions the magnesium Specifications B 90 (sheet) B 91 (forgings) B 93 (ingot) and B 199 (permanent mold castings) are being retained as tentative. Also being retained in the tentative status are B 36 (aluminum bus bars) and B 247 (aluminum die forgings).

Still unresolved is the question of a tentative recommended practice for codification of aluminum tempers. Two codification systems are under consideration in the subcommittee and, if a substantial consensus of acceptance for one of the two can be obtained from subcommittee members, it will then be submitted to the main committee for approval.

The results of 1-yr exposure tests at New York, State College, and Kure Beach and the six-month tests from Point Reyes are currently being evaluated. Facilities are now available at Freeport, Tex., and the specimens for this location will be put on exposure within the next few months.

B-8 Electrodeposited Metallic Coatings

Although some years ago the committee agreed not to undertake work on specifications for plating salts and plating anodes, the present membership has reversed this previous stand and task groups have been set up to investigate the practicability of developing specifications for this particular phase of electroplating work. Committee B-8 has also set up a task group to investigate the desirability of specifications for plated coatings presently not covered. These would include such materials as gold, silver, rhodium, etc.

Revisions in B 242, Recommended Practice for the Preparation of High-Carbon Steel for Electroplating are currently being balloted upon by the committee. These revisions provide for the inclusion of electrolytic polishing among the Final Pretreatment Procedures.

A recent survey has indicated that there is no interest in supplemental treatments for electroplated lead coatings and consequently this section of Subcommittee V on Supplementary Treatments for Metallic Coatings has been discharged.

The study of tin and tin alloy coatings, excluding electrolytic tin plate, will resolve a number of questions as to the performance of these coatings. Present work contemplates an immediate study of tin, tin-lead, and tin-zinc coatings. Future work will cover tin-copper, tin-nickel, and tin-cadmium coatings. The problems to be consid-

The principals in the very enthusiastically received Symposium on Design of Experiments held during Committee Week, are, left to right: W. J. Youden, National Bureau of Standards; W. G. Cochran, Johns Hopkins University; Besse B. Day, and F. R. Del Priori, Naval Experimental Station.

ered in connection with all of these materials are corrosion resistance, solderability, and susceptibility to phase transformation. Among the uses are electronics, refrigerators, air conditioners, wire, pistons, and food, dairy, and beverage industries using containers other than "cans."

B-9 Metal Powders

Committee B-9 on Metal Powders and Metal Powder Products held its annual meeting in New York on February 19, preceded by meetings of all its subcommittees and sections.

The Subcommittee on Nomenclature and Technical Data has a project under way in which data for the mechanical properties of structural parts produced to Specifications B 222 are being collected. With regard to the term "sintering" as a coined word describing the products of powder metallurgy, considerable controversy has arisen and the subcommittee decided to postpone action until the fall.

Section IIA on Base Metal Powders has almost completed the testing program for developing a compressibility test. It is expected that a standard test method for compressibility will be developed soon. A draft for a method for measuring green strength was thoroughly discussed and will be revised in accordance with this discussion. The method for subsieve particle size analysis of metal powders developed by the section has been approved by the main committee.

Section IIB on Refractory Metal Powders at its initial meeting had appointed three task forces to deal with methods for determining particle size and particle size distribution of refractory metal powders. The task forces were concerned with the permeability method, turbidimetric methods, and photographic methods. All three task forces had gathered information on the details of the test methods as practiced at present, by way of questionnaires. On the basis of these questionnaires, round-robin test programs for all three methods were initiated.

Section IIIA on Self-lubricating Bearings has worked on revisions and additions to Specifications B 202 for Metal Powder Sintered Bearings for more than a year. Changes in the classification of chemical analysis of the material, changes in the table of commercial tolerances, and additions of a recommended size list and recommended press fits and clearances have finally been decided upon and will be submitted to letter ballot of the section.

Section IIIB on Structural Parts has approved specifications for copper impregnated sintered metal powder structural parts from iron and they are being submitted to letter ballot of the main committee. The section has under consideration specifications for parts from iron and iron-carbon compositions and for filter materials from metal powders, which were thoroughly discussed at its meeting.

Section IIIC on Cemented Carbides is writing a group of methods for testing cemented carbides. A method for hardness determination has been approved by the main committee. A method for determining density was discussed at the section meeting and will be rewritten in accordance with the suggestions offered. The section is also developing a scheme of classification of cemented carbides and a method for examining their microstructure.

C-1 Cement

The report of the activities of the Cement Reference Laboratory was especially significant at the meeting of Committee C-1 as it marked the 25th Anniversary of this important activity of the committee. The latest report described the accomplishments of the tenth and latest inspection tour of the Laboratory. This tour covered a three-year period and included visits to 261 laboratories, in which the various apparatus and equipment were checked and calibrated, running from balances and glassware to compression testing equipment.

A revised method of analysis of Darex air-entraining agent has been necessary, due to a change in the material now being used for this purpose. Further work is required, however, before the revision can be presented to the committee. A revised procedure is now being completed for determining sodium oxide and potassium oxide by means of the flame photometer method. A new method of test for heat of hydration of portland cement, which had been previously circulated to the committee, was accepted. This new tentative represents a rapid method based on the existing standard method C 186. A new series of cooperative tests will now be inaugurated to check the accuracy of the bleeding rate of portland cement mortar, using the mechanical mixer, and with calibrated flow tables. In the current cooperative work on fineness tests among five laboratories there was achieved excellent agreement in the density determinations by the Le Chatelier method.

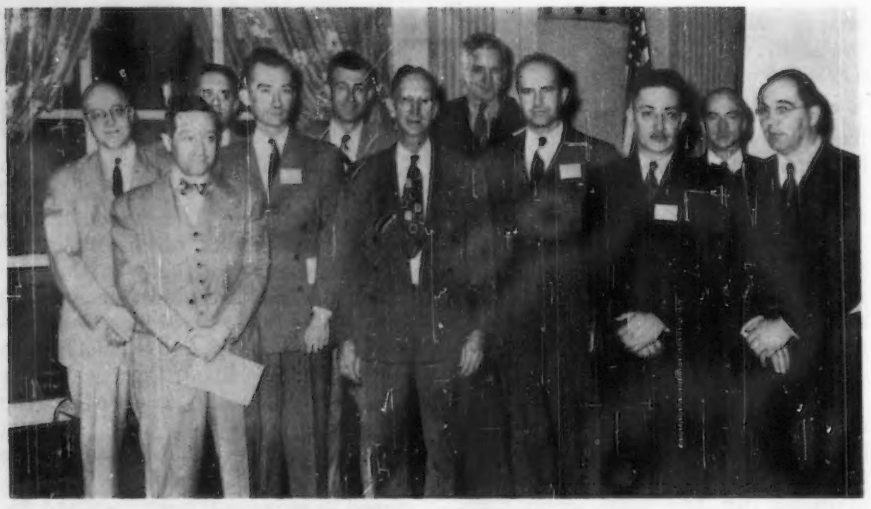
Nine laboratories are participating in a cooperative series to establish the influence of machine mixing on mortar strength test results, which will also involve a comparison between the proposed flexural test procedure and the compressive test. Revisions to Tentative Method of Test for Calcium Sulfate in Hydrated Portland Cement Mortar (C 265), previously circulated to the committee, together with editorial changes, were accepted for committee letter ballot. These revisions were designed to improve the accuracy and dependability of this method. Data are also being collected on the use of a polyethylene bag in curing the mortar.

A new tentative specification was accepted for portland-pozzolan cement. This specification covers two types of hydraulic cement, Type IP, in which the clinker conforms to the chemical requirements of Type I or Type II portland cement; and Type IP-A, which is an air-entraining portland-pozzolan cement. The new specification contains requirements for the pozzolan constituent. There was discussion of the proposed tentative specification for slag cement, in the attempt to resolve criticisms of the earlier draft of this proposed specification. No recommendation will be made until the next meeting of the committee. Cooperative tests on the determination of air content in masonry cements were reported, in which three methods are being compared, namely, ASTM Method C 185, the proposed Federal Specification method, and that found in ASTM Specification C 91. Further study is progressing in respect to water retention apparatus.

Continuing with the current practice of highlighting the work of one working subcommittee at each meeting, an illustrated talk on the activities of the Working Committee on Sulfate Resistance was given by the Chairman, William Lerch, Portland Cement Assn.

C-3 Chemical-Resistant Mortars

The acceptance of a proposed tentative method of test for bond strength of chemical-resistant mortars, subject to confirming letter ballot of the committee, represented the completion of much study and research by Committee C-3 in developing this very important strength criterion. This method will cover a procedure for determining the bond strength between chemical-re-



Some of the members and authors who participated in the Committee E-12 Symposium on Color of Translucent Products held during Committee Week, are, left to right: W. A. Gould, Ohio State University; I. Stone, Wallerstein Laboratories; P. French; M. Keeney, University of Maryland; Vice-chairman G. W. Ingle, Monsanto Chemical Co.; D. B. Judd, National Bureau of Standards; F. Scofield, National Paint, Varnish, and Lacquer Assn.; E. J. Culp; C. L. Babcock; D. Farnsworth, U. S. Naval Submarine Base; A. J. Werner, Corning Glass.

sistant mortars and chemical-resistant brick conforming to the existing ASTM Tentative Specification for Chemical-Resistant Masonry Units (C 279).

A proposed method for determining the chemical resistance of resin mortars was reported in an advanced state of completion. This will be a companion method to the existing ASTM Tentative Method of Test for Chemical Resistance of Hydraulic-Cement Mortars (C 267). Two existing tentatives, namely, Tentative Specification for Sulfur Mortar (C 287) and the Tentative C 267, just referred to, were recommended for advancement to standard.

C-7 Lime

The best means or procedure for determining the bond of lime mortars will receive the attention of the committee. The function of lime in respect to elasticity and flexibility of a mortar will also receive initial consideration by the Subcommittee on Research. Additional data will be collected through an accelerated program on soundness of lime mortar through the cooperative efforts of the subcommittees on research and on methods of tests.

A new field of endeavor was inaugurated through the appointment of a special subcommittee to explore and study the need for a specification for pozzolanic materials for use with lime products. In the field of chemical lime, the types of lime most desirable for silica brick manufacture will be determined, and work will be started on two proposed specifications for lime for neutralizing acids.

C-8 Refractories

Industrial surveys of refractory service conditions in various industries have been an important and valuable part of the accomplishments of Committee C-8 as published in the Manual of ASTM Standards on Refractory Materials.

Committee C-8 announced a new survey was ready for publication covering the field of hot metal mixers.

A permanent section is authorized under the Subcommittee on Classifications, whose first assignment will be the classification of ladle brick. The determination of alkalies by flame photometry was reported progressing satisfactorily, and an informative and useful report is expected by the next meeting of the committee. The Tentative Method of Test for Disintegration of Fireclay Refractories in an Atmosphere of Carbon Monoxide (C 288) was recommended for adoption as standard. In the Standard Specifications for Fireclay-Base Castable Refractories for Boiler Furnaces and Incinerators (C 213), tentative revisions were accepted which will more clearly define the particle size of the two classes of materials covered. Renewed attention will be given to slagging through the reactivation of the section, with J. F. Kelly, Department of the Navy, as chairman.

C-9 Concrete

The greatly expanded use of dry concrete mix materials in packaged form has been recognized by Committee C-9, by the authorization of a new subcommittee which will study and possibly propose specifications as a means of insuring a high quality product in this field. This subcommittee will be formed with suitable personnel, either presently on the committee, or invited on a consulting basis to provide a qualified group to prepare such specifications.

As a result of a cooperative test program by the Subcommittee on Chemical Reactions of Aggregates in Concrete, two recommendations were presented which have been previously circulated to the committee in a written report. The recommendations include a proposed method for measuring potential volume change of cement-aggregate combinations and a revision of the existing chemical method (ASTM C 289) in which the single-end point titration method is substituted for the double-end point calculations. This report will first be published in the ASTM Bulletin. In the study of durability of concrete, it was reported that efforts will be concentrated on an analysis of supposedly good concrete structures and on construction practice in the over-all study of durability of concrete. Pulse velocity techniques is the current work of the Subcommittee on Dynamic Testing of Concrete, with a proposed method to be circulated to the committee for information. New work in the study of aggregate mineralogical characteristics will consist of developing a recommended practice for field investigation of deleterious materials in mineral aggregates.

The Tentative Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory (C 192) was recommended for adoption as standard with certain revisions including more specific descriptions of tamping rods. A tentative revision also will be proposed at the next meeting of the committee as the result of a study made on the effect of capping materials on concrete cylinder strengths. A new Tentative Method of Test for Volume Change of Concrete Products was accepted, subject to committee letter ballot, which is intended for use as a routine standardized procedure on such concrete products as masonry units, concrete pipe, cast stone, or concrete sections.

Subcommittee study has now been completed on three important activities of the committee, namely, a Proposed Specification for Lightweight Aggregate for Insulating Concrete, a Proposed Specification for Fly Ash for Use as an Admixture in Portland-Cement Concrete, and a group of revisions of the Standard Specifications for Ready-Mixed Concrete (C 94). These proposed specifications will be circulated to

the committee in order that action may be taken at the next committee meeting. Several tentative methods of tests were approved for adoption as standard, these including Tentative Method of Sampling Fresh Concrete (C 172), Tentative Method C 192 (as referred to earlier), Tentative Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method (C 231), Tentative Method of Test for Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel (C 234), and Tentative Recommended Practice for Petrographic Examination of Aggregates for Concrete (C 294). The tentative revisions of the Standard Method of Test for Cement Content of Hardened Portland-Cement Concrete (C 85) were also approved for adoption as standard.

C-11 Gypsum

Use of aluminum foil in connection with gypsum lath was recognized by Committee C-11 in a proposed revision in the Specifications for Gypsum Lath (C 37) which will include a requirement and test method for this material, the test method including a determination of thermal properties. Other revisions accepted by the committee include a completely rewritten draft of the Tentative Specifications for Gypsum Concrete (C 317) and changes in the sampling requirements of Specification for Gypsum Plasters (C 28) and Specification for Gypsum Partition Tile or Block (C 52).

Suggested changes in the gradation of aggregate in the Tentative Specification for Inorganic Aggregates for Use in Interior Plaster (C 35) have been referred to the appropriate subcommittee, including recommendations from the Contracting Plasterers International Assn. involving closer grading limits of sand, and recommendations from the Vermiculite Assn.

C-12 Mortars for Unit Masonry

The arrangement of designations for the several types of mortar mixes listed in the Tentative Specification for Mortar for Unit Masonry (C 270) has been given considerable attention in the committee in order to prevent any misinterpretation of their relative quality. A new series of designations was accepted at the committee meeting, this new series being of a somewhat "fool-proof" nature in that the designations cannot be construed to have any relation to each other. The new designations of the mortar types, used in connection with mortar proportions by volume in the specification (Table II), are as follows:

Type M—Formerly Type A-1
Type S—Formerly Type A-2
Type N—Formerly Type B
Type O—Formerly Type C
Type K—Formerly Type D

The effect of admixtures on bond in reinforced brick masonry will be considered by the Subcommittee on Research in addition to a continuing project on the pointing of mortars in which plasticity measurements are involved. Mortar flexibility is still another subject of consideration for research. Consideration was given to criticism on the grading requirements in Tentative Specifications for Aggregate for Masonry Mortar (C 144), with the thought that an escape clause might be included, based on the test method found in Specification C 270. The report on the work on the Subcommittee on Efflorescence, including the proposed test method, was given final review preliminary to its publication in the ASTM BULLETIN.

C-15 Manufactured Masonry Units

A specification for a new type of building unit has been accepted by the committee for submittal to letter ballot. This unit is now referred to as a brick-block clay unit, which because of its volume of voids and cross-sectional design does not fall into either the brick or tile classification. A task group was appointed, consisting of general interest members only, to study and report on the advisability of developing a new specification for low-moisture volume change type of concrete masonry units. This group will also study the need for more specific requirements in the concrete unit specifications, including the possibility of setting up different classes of blocks based on performance requirements. The third new project authorized was to consider a proposed specification for ceramic power packings by the Subcommittee on Chemical-Resistant Units.

Action was taken to recommend adoption as standard of certain tentatives under the jurisdiction of the committee, including Tentative Specification for Structural Clay Facing Tile (C 212); Tentative Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units (C 126); and Tentative Specification for Chemical-Resistant Masonry Units (C 279). Considerable attention was given to the subject of capping of concrete units, with a tentative revision accepted of Standard Methods of Sampling and Testing Concrete Masonry Units (C 140), allowing sulfur capping as an alternate to the cement-gypsum capping mixture.

In an attempt to streamline the organization of the committee for more effective operation, action was taken to combine Subcommittee II on Clay Building Brick, Subcommittee IV on Paving and Sewer Brick, and Subcommittee VII on Structural Clay Tile, which will now be known as Subcommittee II on Clay Brick and Structural Tile.

C-16 Thermal Insulating Materials

The effect of moisture and water-vapor transmission of insulating materials received considerable attention at the meetings of Committee C-16 and its subcommittees. The special research program at The Pennsylvania State University has shown good progress, especially in the use of the probe method of measurement on dry materials. However, the proper technique for the measurement of wet materials by this method is requiring more study. A final draft of the proposed method for determining water vapor transmission of materials used in building construction was accepted for letter ballot of the committee.

It was the decision of the committee to discontinue the existing Tentative Methods of Test for Water Vapor Permeability of Sheet Materials Used in Connection with Thermal Insulation (C 214), in view of the publication of the Tentative Methods of Test for Measuring Water Vapor Transmission of Materials in Sheet Form (E 96). The latter method has essentially the same coverage and therefore can be used for thermal insulating materials.

Certain tentatives and tentative revisions were recommended for adoption as standard, these including Method of Test for Compressive Strength of Preformed Block Type Thermal Insulation (C 165), Tentative Specification for Mineral Wool Blanket Insulation (Metal-Mesh Covered) (Industrial Type) (C 263), and Tentative Specification for Mineral Wool Blanket-Type Pipe Insulation (C 280).

Proposed tentative specifications were accepted for letter ballot of the committee covering calcium silicate block, calcium silicate pipe covering, and cellular glass block. Proposed test methods approved for letter ballot included the determination of adhesion of dried thermal insulating cements, the compressive hardness of thermal insulating cements,

specific heat, and linear shrinkage upon soaking.

The development of specifications covering additional thermal insulating materials was authorized to include cork pipe-covering insulation and cellular-glass thermal pipe insulation. An important test method, that of determining the density at which loose fill insulations should be applied, has shown good progress with data indicating reproducibility of results. A companion method for measuring the density using vibration was also reviewed. The adaptation of thermal conductivity measurements determined by the Standard Method C 177 to low temperatures was recommended, and the proper subcommittee will study this for possible revision of the method.

The problem of developing a suitable small scale test for measuring flame spread or fire resistance is still receiving attention in at least three of the subcommittees dealing with specific types of thermal insulating materials. Current activity will now include the preparation of review of fire test data on thermal insulating materials where the tunnel test method as described in ASTM Tentative Method E 84 was used and the angle-iron frame procedure found in Federal Specification SS-A-119a.

C-19 Structural Sandwich Constructions

Primary activities in the subcommittees are the preparation of test procedures for the components of sandwich construction and also for sandwich construction itself.

A proposed compression test method for cores received considerable discussion regarding definitions and limitations of specimen dimensions. The test method needs some revision in minor details before submittal to committee letter ballot.

A test for delamination of cores has been circulated for comment. After incorporating suggestions as to enlarging the scope and significance of the test as well as some definitions and report requirements, it appears that this test method may be ready for letter ballot in the near future.

A possible standard test for core thickness determination was discussed. A report was given on results of thicknesses determined by two different methods—one using a large foot size under constant load and the other using a long roller under constant load. The results showed that only small differences appeared between the measurements of several types of core.

A discussion of test methods for sandwich construction revolved around the edgewise compression and the flexure test which had been sent to members for letter ballot. Considerable discussion took place on length of specimen and type of end support for the compression specimen. It is possible that the methods can be revised and circulated for approval before the ASTM Annual Meeting. Adoption of a peel test method was temporarily delayed awaiting test data from several sources for comparisons of various test methods.

A brief section meeting was held for those interested in conducting exposure tests, and a tentative testing plan was devised and presented to the subcommittee for comment regarding tests to be made and sizes of exposure panels. A detailed description is to be written and circulated to the committee for comment. The work is to coincide with the exposure program and sites arranged by the Advisory Committee on Corrosion.

C-22 Porcelain Enamel

Method of test for reflectivity and coefficient of scatter of white porcelain enamels was one of the two new methods accepted by the committee, subject to letter ballot. The purpose of this determination is to characterize any batch of porcelain enamel, so that the reflectance of an enamel coating of any thickness within the desired range can be predicted. The second new method accepted was the 45-deg gloss test, following considerable discussion on a decision as to which angle would be most practical for use.

Two existing tentatives were approved for advancement to standard,

Allan W. Dow, photographed at Committee Week, has been a member of the Society longer than any other individual. Mr. Dow, an engineering consultant in New York City, joined ASTM in 1898.

Method of Test for Resistance of Porcelain Enameled Utensils to Boiling Acid (C 283) and Method of Test for Sieve Analysis of Wet Milled and Dry Milled Porcelain Enamel (C 285).

Reports were presented indicating progress on a number of proposed test methods which are in various degrees of completion, including a torsion test based on a procedure developed by the Porcelain Enamel Institute, a tearing test, a sag test for use in evaluating enameling iron, a fusibility test known as the flow button method, and the evaluation of set characteristic of clays. Activity in the field of finished products continued to center around such test methods as abrasion, thickness, scratch, continuity of coating, metal marking, and impact.

D-1 Paint, Varnish, Lacquers

Committee D-1, its Advisory Committee, and 71 of its subcommittees and working groups held meetings with an attendance of about 225 members and guests.

The meeting was highlighted by a most interesting and informative technical paper, splendidly illustrated with colored slides, on "Photochemical Deterioration of Automobile Lacquers" by Roger Saur, Research Laboratories Director, General Motors Corp.

Latex Paints.—Work on latex and emulsion paints is being undertaken in Committee D-1 through the organization of a new subcommittee under the chairmanship of Paul T. Howard, National Bureau of Standards. Working groups have been established to study and develop methods for the following tests: (1) washability and scrubability, (2) stability to freezing and thawing, (3) efflorescence, (4) package stability, (5) special methods for exterior emulsion paints.

Subcommittee II on Drying Oils is continuing its study of a proposed sampling procedure. Two methods for determining total iodine value are being investigated, one involving hydrogenation, and the other catalytic halogenation. Proposed specifications for safflower oil were submitted for publication as information only. Studies are being undertaken on analytical methods for fatty acids. The Group on Foots and Break of Raw Soybean Oil has set up a collaborative testing program to determine proper specification ranges for degummed soybean oil. Changes in the Specifications for Oiticica Oil (D 601) are in preparation. Revisions in the Specifications for Raw Soybean Oil (D 124) were accepted for

letter ballot. A new group was appointed to develop a method of test for flash point of vegetable oils by the Pensky-Martens closed cup tester. The first round-robin study has been completed on spectrophotometric analysis of drying oils. Action was taken to revise the Methods of Testing Drying Oils (D 555) to reinsert a requirement requiring the original Tung Oil Thermometer 10 C to be used in place of the thermometer now specified.

Subcommittee IV on Traffic Paint recommended a revision of the Standard Method of Test for No-Pick-Up Time of Traffic Paint (D 711) increasing the wet film thickness from 4 to 15 mils. A new proposed tentative method of test for no-smear time of traffic paint is being developed. The subcommittee plans to submit for publication in the ASTM BULLETIN data on the studies of no-dirt-retention time of traffic paint, also on the cooperative tests of sieve analysis of glass beads, and from the cooperative tests of the settling properties of traffic paints. An accelerated test for traffic paint durability is under study. Work is planned on (1) a glass bead reflection test, (2) a method of evaluation of the degree of wettability of reflecting glass spheres by traffic paint.

Subcommittee V on Volatile Solvents for Protective Organic Coatings recommended that the Test for Viscosity Reduction Power of Hydrocarbon Solvents, now published as information, be issued as tentative. A new group is to be appointed to study tests for odor and methods for classifying odors. This subcommittee has in preparation reports on the following three projects: (1) on studies of the test for viscosity reduction power, (2) review of evaporation methods, and (3) data on the cooperative work on distillation test methods.

Subcommittee VII on Accelerated Tests for Protective Coatings reported letter ballot approval of a new series of photographic standards for evaluating the resistance to blistering of paints on metal when subjected to immersion or other exposure to moisture or liquids as covered by Method D 714. The Tentative Method for Water Immersion Test of Organic Coatings on Steel (D 870) was recommended for adoption as standard. Work by nine cooperating laboratories on the test program to determine the effect of tap water *versus* demineralized water in light and water exposure apparatus is well under way. Groups were appointed to undertake work on two new subjects as follows: (1) on yellowing of interior finishes, and (2) on chemical resistance of appliance enamels.

Subcommittee VIII on Methods for Chemical Analysis of Paint Materials authorized submission to letter ballot of a new Tentative Method for the Analysis of Titanium Dioxide. A complete revision of the Standard Method of Chemical Analysis of Dry Mercuric Oxide (D 284) has also been completed. Two new working groups were authorized on (1) revision of the test for nonvolatile vehicle in the Standard Methods of Chemical Analysis of White Linseed Oil Paints (D 215), and (2) preparation of a specific resistance method for soluble salts of iron oxide pigments.

Group on Color of Transparent Liquids, of Subcommittee IX on Varnish, is redefining its objectives in view of (*a*) increasing preference for glass disk color standards, (*b*) increasing use of the Hazen scale for lighter colors, and (*c*) dissatisfaction with the hue of the paler range of the Gardner 1933 standards. Studies will be made of two instruments with experimental tubes and disks in comparison with glass disks and liquid standards at several cell thicknesses. Extension of the chloroplatinate solutions up through the entire Gardner 1933 range will be studied with due recognition of the high cost of the darker tubes.

Group on Gloss of Dry Transparent Films reported results of tests of goniophotometric and 60-deg gloss measurements on two sets of finished wood panels. In comparing visual gloss ratings with instrument gloss readings, some directional and surface contour anomalies appear which seem to be resolved by using a narrower beam aperture in the 60-deg glossmeter specified by Method D 523. Work on a test for skinning of varnishes is being reactivated, and studies are being undertaken of a procedure for rosin determination in varnish and a similar procedure for dryers.

Group on Abrasion Resistance reported that wear tests of varnishes on floor surface panels have not failed sufficiently yet to determine their degree of correlation with sand or other impingement tests already completed. The Group on Phthalic Anhydride Analysis reported that samples from seven suppliers were being furnished to 11 cooperative laboratories for test.

Subcommittee X on Optical Properties reported that six working groups are actively engaged in developing methods for color difference measurements with the following instruments: (1) Beckman Spectrophotometer, (2) General Electric Spectrophotometer, (3) Hunter Color Difference Meter, (4) Color Eye, (5) Colomaster Colorimeter, and (6) Photovolt. Satisfactory progress is being made with these instruments and the cooperative testing of sets of 24 paint panels representing three color differences in each of six colors.

Subcommittee XI on Resins submitted a proposed Tentative Method for Determination of Apparent Free Phenols in Synthetic Phenolic Resins or Solutions Used for Coating Purposes. This subcommittee has a number of working groups actively studying new test procedures on the following subjects: (1) unsaponifiable and fatty acid content of alkyd resin, (2) identification and determination of urea and melamine in nitrogen resins, (3) degree of cure of thermosetting phenolic resins, (4) identification and determination of individual vinyl type resins, (5) study of foil method for determination of total solids, (6) round-robin on ring-and-ball softening-point test by Method E 28 using both the press and pour procedures, (7) study of solution viscosities, and viscosity determinations of vinyl resins, (8) color formation when reacting glycerine with phthalic.

Subcommittee XIII on Shellac presented a new method of test for acid number of bleached lac and bleached lac varnishes for inclusion in Methods D 29. Plans were made for revision of Specifications for Dry Bleached Shellac (D 207) to include a requirement for acid number; also a revision of the Specifications for Shellac Varnishes (D 360) to include insertion of an iodine number requirement for Grade A orange shellac varnish and an acid number requirement for regular and refined bleached lac varnish; revision of Specifications for Orange Shellac and Other Lacs (D 237) to include iodine number requirements for Grades A, B and C orange shellac and button lac. Cooperative tests are to be made on a new proposed method for color of lac resins which eventually may replace the method now in Method D 29.

Subcommittee XV on Pigments discussed the first draft of a proposed recommended practice for reporting particle size characteristics of pigments. The revised draft will be submitted for review by the subcommittee. Studies are under way of methods of test suitable for evaluating the flocculation resistance and solvent stability of copper phthalocyanide blue pigments.

The proposed Method of Test for Flash Point of Volatile Flammable Materials by Tag Open-Cup Apparatus published as information for the past two years was recommended as tentative. Work will continue on further studies of this method in order to improve the precision. Future work will include study of the special rotating cup flash tester for determining the flash point of viscous materials.

A proposed Tentative Method for Measuring the Hardness of Paint, Varnish, and Lacquer Films by the Knoop Indentor has been completed and will be sent to letter ballot of the subcommittee. Proposed Tentative Methods for Fire Retardancy of Paint Films which covers the cabinet method and the stick and wick method are in preparation. A new task group was appointed to develop a method for the weight per gallon of paint, varnish, lacquer, and related products. A revision of Method D 562 is under study covering the alternate use of the stroboscopic timer with the Stormer viscosimeter for measurement of paint viscosity. A review of several years' work on consistency of paint is being prepared and may be submitted for publication in the ASTM BULLETIN.

Subcommittee XVI on Printing Inks submitted its first tentative method for fineness of grind of printing inks by the production grindometer. The fineness of grind of a printing ink is a measure of the size and prevalence of over-size particles in the ink. This subcommittee has groups actively studying other test methods for printing inks which include rub-proofness, drying time, specific gravity, paper-ink relationship, tinting strength, and rheological properties.

Subcommittee XXIX on Painting of Metals reported completion of methods for preparation of aluminum surfaces for painting and also of separate methods for preparation of magnesium surfaces for painting. After editorial revision, these will be submitted to subcommittee letter ballot. Work is continuing on the proposed methods for classifying ferrous surfaces for painting. It is hoped that it may be possible to have available at the June meeting color prints of the various reference standards being considered for use in this classification system.

D-2 Petroleum Products and Lubricants

Two symposiums featured the very interesting and productive series of meetings of this committee in Philadelphia, February 14 to 19. 360 members and guests attended meetings of 95 technical committees, research divisions, and subcommittees. Actions were taken to refer for final letter ballot approval a number of new tentative methods of test, several methods to be published as information, and recommendations for the adoption and revision of existing standard and tentative methods and specifications.

The first symposium, held February 15, was devoted to the subject of "Gum and Storage Stability of Motor Gasoline." It was sponsored jointly by Technical Committee A on Gasoline and Research Division V on Analysis of Fuels. The information presented in the following five papers comprising the symposium was considered to be of great value in clarifying the problem of motor gasoline stability:

The Invalid Induction Period by William R. Power, Cities Service Oil Co.

Accelerated Storage Test for Gasoline Stability by Minor C. K. Jones, Esso Labs.

Factors Affecting Motor Gasoline Stability by A. V. Cabal, Socony-Vacuum Oil Co.

Paper Chromatography as Applied to Studies of Induction System Deposits by C. R. Bauer, E. I. du Pont de Nemours & Co.

Correlation of Induction Tests with Motor Fuel Stability by Robert W. Donahue, Sun Oil Co.

The second symposium was devoted to the subject of diesel fuels and was sponsored by Technical Committee F on Diesel Fuels. There was an attendance of over 250 at this session, and considerable interest was evidenced in the nine papers presented, the titles of which were as follows:

Diesel Fuel Supply and Demand Outlook by C. M. Larson, Consulting Engineer, Sinclair Refining Co.

Technical Problems Associated with Diesel Fuels:

In Inter-State Coach Operations by W. A. Duvall, The Greyhound Corp.

In Railroad Operations by R. W. Seniff, The Baltimore & Ohio Railroad Co.

In Marine Operations by C. E. Habermann, Socony-Vacuum Oil Co., Inc.

In Contractors' Equipment by J. W. Vollentine, Caterpillar Tractor Co.

Distribution and Storage Problems for Diesel Fuels by C. C. Moore, Union Oil Co. of Calif.

The Utilization of Burner Fuels in Diesel Engines by H. V. Messick, Ashland Oil & Refining Co.

Survey of Fuel Oils Available at Roadside Filling Stations by W. A. Howe, Gulf Oil Corp.

Diesel Fuel Specifications Requirements by C. C. Ward, U. S. Bureau of Mines.

It was announced that Committee D-2 had approved by letter ballot the ASTM Copper Strip Corrosion Standards, to be used in connection with ASTM Method D 130. These reference color standards consist of a set of various colored strips (6 color lithograph on aluminum) and sealed in a plastic case. In evaluating a test specimen, it is compared with the reference standard in light reflected at an angle of about 45 deg. The ASTM Copper Strip Corrosion Standards will become available following formal acceptance by the Society of this revision of Method D 130.

The Research Division on Calorimetry has presented a Method of Test for Estimation of the Net Heat of Combustion of Liquid Petroleum Hydrocarbons, which was accepted for publication as information only.

Pictured at the Committee Week meeting of D-4 on Road and Paving Materials are left to right: C. E. Proudley, North Carolina State Highway; E. W. Klinger, Standard Oil of New Jersey; Chairman C. A. Carpenter, Bureau of Public Roads; A. T. Goldbeck, National Crushed Stone Assn., Inc.; Secretary B. A. Anderton, Barrett Div., Allied Chemical & Dye Corp.

The Section on Specifications is conducting a gasoline survey to determine whether the three types, A, B, and C, of gasoline with different distillation ranges, as covered by ASTM Tentative Specifications D 439, are desired. The committee plans to review the U. S. Bureau of Mines "National Motor Gasoline Survey" for the winter 1953–54 to determine whether any change in the octane number requirement should be proposed in Specifications D 439.

Technical Committee B on Lubricants submitted for publication as information a new Method for Evaluating the Galvanic Corrosion of Instrument Oils.

Technical Committee C on Turbine Oils plans to sponsor a Symposium on Oxidation of Turbine Oils at the 1955 Annual Meeting. The Section on Rusting is endeavoring to obtain case histories and decided to defer its cooperative test program until such information is available. There are two short-time oxidation methods being studied by cooperative tests. The Tentative Method of Test for Rust-Preventing Characteristics of Steam-Turbine Oil in the Presence of Water (D 665) was recommended for adoption as standard, also the Method of Test for Oxidation Characteristics of Inhibited Steam-Turbine Oils (D 943) was revised and recommended for adoption as standard.

The Technical Committee on Grease reported that it has under consideration plans for sponsoring two symposiums, one to be devoted to the shear stability of lubricating greases, and the other to rapid methods of evaluation of lubricating greases from the viewpoint of simulated service. The committee has undertaken a study of noise level in grease lubricating bearings.

Technical Committee H on Light Hydrocarbons recommended revision and adoption as standard of the Method of Test for Total Inhibitor Content (*p*-Tertiary-Butylecatechol) of Butadiene (D 1157). The revision will bring the method into accord with the corresponding test method of The Rubber Reserve.

A comprehensive Symposium on Methods for Testing Liquefied Petroleum Gases will be held at the Statler Hotel in St. Louis, September 27 and 28, 1954. This symposium is being held under the joint sponsorship of ASTM Committees D-2 and D-3 on Gaseous Fuels and the California Natural Gasoline Assn. and the Natural Gasoline Assn. of America. The symposium will include a number of papers on all phases of testing of LPG including many of the quick field tests now used. Subjects to be covered include composition of hydrocarbon and nonhydrocarbons, tests for physical properties such as vapor pressure and specific gravity, corrosion, and sampling. The matter of safety in handling of LPG in the laboratory and in transportation will also be covered. Among the miscellaneous subjects to be covered are Btu value, odor test, tests for flammable mixtures, octane number, and analysis of products of combustion.

Technical Committee J on Aviation Gasoline presented for publication as tentative a new Method of Test for Smoke Point of Jet Fuels. This method was requested by the military and is intended for use in the study of carbon deposition in turbojet combustors. The smoke point under the conditions prescribed in the method is defined as the maximum flame height in millimeters at which the flame will burn without smoking. This method was completed following a series of cooperative tests by 12 laboratories on samples of some 16 different fuels.

A proposed Method of Test for Filterability of Jet Fuels was accepted for publication as information only. Studies of this test have indicated that it gives satisfactory results as a laboratory method. The method will include an introduction setting forth its limitations and precautions to be taken in its application. The committee decided to make available in 4-oz bottles the maximum and the minimum color samples for Grade 108–135 aviation gasoline under ASTM Specifications D 910. These samples are now being made available in 1-gal cans, and it was decided to use a water solution of the color standard and make them available in the smaller 4-oz containers following the practice used by Wright Field for the samples of the other grades of aviation gasoline.

The Technical Committee on Tractor Fuels recommended the adoption as standard of the Tentative Definition and Specifications for Farm Tractor Fuels (D 1215).

The Research Division on Combustion Characteristics reported that it has in progress a testing program which it is expected will result in improving the precision of engine test methods for rating fuels. Particular emphasis is being given to improving the reproducibility of the Aviation Method and also the Supercharge Method. A new meter for use in the Cetane Method is under study which is intended to improve the precision of the Cetane Method.

Research Division on Measurement and Sampling.—The ASTM Manual on Calibrating Liquid Containers, which includes detailed procedures for upright tanks, is now in the process of publication. Studies are being made of automatic devices for sampling. Improved means for measuring temperature of petroleum products are also being studied. Copies of the Wall Chart for Table 5, Reduction of Observed API Gravity to API Gravity at 60 F are now available from ASTM Headquarters. The chart is available in four separate sheets covering API Gravity and Temperature Ranges:

	API Gravity Range	*Temperture Range*
Sheet No. 1..	0– 99 deg	0– 50 F
Sheet No. 2..	0– 50 deg	50–150 F
Sheet No. 3..	50–100 deg	50–150 F
Sheet No. 4..	0– 49 deg	150–250 F

Action was taken to proceed with the necessary calculation work in order to expand Table 5 to provide conversion values for every tenth degree API Gravity over the entire range covered by Table 5. The present table gives values for each degree API Gravity from 0 to 100 API.

Action was also taken to expand Table 6, Reduction of Volume to 60 F Against API Gravity at 60 F, to provide factors for temperatures from 0 F down to −50 F. With completion of this enlargement of Table 6 corresponding changes will also be made in the Abridged Table 7.

The Research Division on Hydrocarbon Analysis recommended for adoption as standard three of its methods, namely, Tentative Methods of Test for Analysis of 60 Octane Number *Iso*octane-Normal Heptane ASTM Knock Test Reference Fuel Blends by Infrared Spectrophotometry (D 1095), for 1,3-Butadiene in C_4 Hydrocarbon Mixtures by Ultraviolet Spectrophotometry (D 1096), and for Density and Specific Gravity of Liquids by Bingham Pycnometer (D 1217). The proposed Method of Test for Hydrocarbon Types in Jet Propulsion Fuels, published as information in 1952, was recommended for acceptance as

Committee D-21 on Wax Polishes also met in Washington. Left to right: J. T. Hohnstine, Boyle-Midway, Inc.; Secretary B. S. Johnson, Franklin Research Co.; M. Fuld, Fuld Bros., Inc.; F. J. Pollnow, Jr., Vestal Labs, Inc.; W. H. Joy, Bell Labs, Inc.; Vice-Chairman J. V. Steinle, Johnson and Son, Inc.; D. M. King, Masury-Young Co.; and Chairman W. W. Walton, National Bureau of Standards.

tentative with some changes resulting from experience with the method. Revisions covering additions to the Tentative Method of Test for Determination of Purity from Freezing Points (D 1016) were also accepted. A proposed Method of Test for Individual Hydrocarbons in C_4 Fraction by Infrared Spectrophotometer Method was accepted for publication as information.

A new **Section J on Analysis of Reference Fuels** is being established in response to a request from the Division on Combustion Characteristics. This section will prepare methods for the analysis of reference fuels used in the rating of engine test methods.

The Research Division on Elemental Analysis submitted as tentative an Amperometric Method for Mercaptan Sulfur in Jet Fuels. A companion Potentiometric Titration Method for Determining Mercaptan Sulfur in Jet Fuels was also recommended for publication as information only. The proposed Method of Test for Chlorine in Lubricating Oils, published as information last year, was recommended for issue as tentative. The Tentative Methods of Test for Phosphorus in Lubricating Oils, Lubricating Oil Additives, and Their Concentrates (D 1091) were revised to include a section on precision. The proposed Method of Test for Sodium in Residual Fuel by Flame Photometer, now published as information, was recommended for issue as tentative. The Research Division on Analysis of Fuels presented a revision of the Tentative Method of Test for Existent Gum in Fuels by Jet Evaporation (D 381) to include procedures for evaluating gum in lubricated gasolines. The proposed Method of Test for Water in Petroleum and Bituminous Products, published as information, which is a contemplated revision of Method D 95, was further revised. Minor revisions were recommended in the Tentative Method of Test for Kinematic Viscosity (D 445) to cover the preparation of the bath before the viscometers, also clarification of the sections on precision. Pumpability tests are under study.

The Division on Color reported that it has in preparation a complete redraft of the present Tentative Method of Test for Color of Lubricating Oil and Petrolatum by Means of ASTM Union Colorimeter (D 155) which will include complete specifications for the new glass color standards. Arrangements have been made with the National Bureau of Standards to have the 16 glass color standards examined and calibrated. These new color standards were described in a paper on "The Determination of the Color of Petroleum Products" by H. M. Hancock and J. J. Watt of The Atlantic Refining Co., presented in the Symposium on The Color of Translucent Products, held in Washington on February 3 during the 1954 ASTM Committee Week.

The Research Division on Volatility has been making an extensive review of the various distillation tests. This resulted in revisions being presented for immediate adoption in the Method of Test for Distillation of Gasoline, Naphtha, Kerosine, and Similar Petroleum Products (D 86), Method of Test for Distillation of Gas Oil and Similar Distillate Fuel Oils (D 158), and Method of Test for Distillation of Natural Gasoline (D 216).

The Standard Method of Test for Distillation of Crude Petroleum (D 285) has been revised and is being reverted to tentative. The Tentative Method of Test for Reduced Pressure Distillation of Petroleum Products (D 1160) was approved for continuation as tentative. However, an appendix was recommended for inclusion with the method to present data and equipment used in a recent study of this procedure.

D-4 Road and Paving Materials

Observation of its 50th Anniversary was the highlight of the meetings of Committee D-4 and its subcommittees. At the completion of the business session, a short, commemorative program was held and recognition given to members of long standing in the committee. Those of the committee who have been members for 30 years and more were presented with specially prepared citations, among them being A. W. Dow, the only surviving member of the original committee organization in 1904.

Several existing tentatives were approved for advancement to standard at the business meeting, these including Tentative Method of Test for Soft Particles in Coarse Aggregates (C 235), Tentative Methods of Sampling Bituminous Materials (D 140), Tentative Specification for Crushed Stone, Crushed Slag, and Gravel for Bituminous Concrete Base and Surface Course of Pavements (D 692), Tentative Specification for Asphaltic Mixtures for Sheet Asphalt Pavements (D 978), Tentative Specification for Fine Aggregate for Sheet Asphalt and Bituminous Concrete Pavements (D 1073), Tentative Method of Test for Effect of Water on Cohesion of Compacted Bituminous Mixtures (D 1075), Tentative Specification for Concrete Joint Sealer, Hot-Poured Elastic Type (D 1190), and Tentative Methods of Testing Concrete Joint Sealers (D 1191).

Significant changes now under consideration in the subcommittees relate to the inclusion of a soundness limitation on aggregate used in water-bound macadam construction in Specifications D 694; a change in No. 3 size of aggregate Specifications D 448; revision of the determination of water by means of distillation in the presence of a volatile solvent in Method D 95, this being jointly reviewed with a subcommittee of ASTM Committee D-2 on Petroleum; and a change in the quality of brass used for scribes in order to provide more realistic limits in the Method of Test for Soft Particles in Coarse Aggregates (C 235).

The committee has concluded that the Tentative Method of Test for Softening Point by Ring and Ball Apparatus (E 28) is not suitable for application to tests of bituminous material and deletion of reference to asphalts, tars, and pitches will be requested. The development of additional testing methods for aggregate includes procedures for evaluating the angularity of sand and for identifying and evaluating the effect of deleterious substances. A program of cooperative tests is planned to establish data on a new method using a "rolling ball" apparatus to determine the loss of volatile constituents of bituminous materials on exposure and the corresponding development of consistency. Study is being given to new techniques for evaluating the resistance of bituminous coatings on aggregate to the "stripping action" of water.

D-5 Coal and Coke

Committee D-5 reported the progress of committee activity both in the United States and at the International Meetings in London and Geneva.

The Mechanical Sampling Section of the Subcommittee on Coal Sampling completed the final details of the Symposium on Coal Sampling to be held at the 1954 ASTM Annual Meeting in Chicago, June 13–18. Plans call for a full-day symposium of seven papers, including a presentation by R. C. Tomlinson, statistical expert of the British National Coal Board.

Subcommittee on Plasticity and Swelling of Coal recommended an alternate method for measuring the index number of the free-swelling button, as a tentative revision to ASTM Standard D 720 (Free-Swelling Index of Coal). The subcommittee also made plans to investigate the Audibert-Arnu dilatometer method for determining caking properties of coal in connection with problems of classification of coals by rank.

Subcommittee on Methods of Analysis submitted a proposed revision of a method dealing with determination of carbon and hydrogen, with its recommendation that it be published as a tentative revision of ASTM Standards D 271, Laboratory Sampling and Analysis of Coal and Coke.

W. A. Selvig, Bureau of Mines, Pittsburgh Station, reviewed the London Meeting of Technical Committee 27 on Solid Mineral Fuels, of the International Organization for Standardization, held November 1 to 6, 1953, at the British Standards Institution, attended by three delegates from ASTM Committee D-5 who represented the United States. Mr. Selvig was head of this United States delegation and the other members were W. M. Bertholf, Colorado Fuel and Iron Corp. and Dr. O. W. Rees, Illinois State Geological Survey. W. A. Selvig also reviewed the Eighth Session of the Classification Working Party, Coal Committee, of the Economic Commission for Europe, which he attended in Geneva, Switzerland, November 9 to 11, 1953, as delegate from the United States. Considerable progress was made at both of these meetings toward international agreement on specifications and standard methods of analysis for coal.

D-6 Paper and Paper Products

The committee held its first meeting of 1954 at ASA Headquarters, New York City, February 18 and 19. The various subgroups reported as follows:

Sampling—A revision of the Standard Method of Sampling Paper and Paper Products (D 585) was discussed at length. The opinion was expressed that the difficult problem of sampling paper in large rolls might be resolved by a simplified procedure for plant use as well as a statistically sound laboratory procedure which could be used as a referee method.

Chemical Test Methods—Suggestions for the revision of the Standard Method of Test for Starch in Paper (D 591) were reviewed, including: the use of an enzyme followed by an analysis of the degradation product, and a colorimetric method which may be used in preference to the gravimetric method for starch determination.

Physical Test Methods for Paper—The discussion centered about the fact that many of the paper methods do not contain a statement of significance. Since such a statement defines the limitations and reliability of a method the subcommittee expects to devote considerable time to preparing such statements for the existing methods.

Specifications for Paper—The proposed specification for heavy-duty shipping sack kraft paper, natural color, was discussed at length. The revisions suggested at the meeting will be noted and the specification issued for subcommittee ballot.

Editorial—It was proposed that a general review of all the methods and specifications under Committee D-6 jurisdiction be made for uniformity and completeness with regard to a statement concerning significance of test.

D-8 Bituminous Waterproofing and Roofing Materials

A new Subcommittee on Rheological Properties authorized at the committee meeting will fill a long-felt need for the development of test methods for measuring the flow properties of bituminous materials used in waterproofing, roofing, and siding products, with primary attention being given to flow properties within a temperature range corresponding to the service conditions customarily encountered by the use of bituminous materials.

The new subcommittee will replace some of the functions of the older subcommittee on ductility, which has now been discontinued. It will be the objective to interpret the meaning of flow data in terms of types of performance. Simplification and rationalization of consistency testing will be attempted through the selection, whenever practical, of fundamental testing devices.

A new specification for asphalt-saturated burlap fabric was approved for committee letter ballot, following an extensive period of study and development.

D-11 Rubber and Rubber-like Materials

Committee D-11 and 16 subcommittees held meetings attended by approximately 135 members and guests. Actions were taken on a number of new specifications and test methods, and plans were initiated for undertaking work on other test procedures.

A comprehensive glossary of terms used in the rubber industry has just been completed, containing over 2000 terms and comprising some 156 single-space typed pages. This extensive list of terms has been in preparation for some years by Subcommittee VIII on Nomenclature and Definitions. Members of the committee have been requested to review the glossary for the purpose of offering criticisms and suggestions.

Coated Fabrics.—Considerable interest has been evidenced in the subject of coated fabrics. Committee D-11 has carried on considerable work on fabrics coated with rubber and rubber-like materials, and all the work on coated fabrics is accordingly to be centered in Committee D-11 with participation on the part of other interested committees, such as Committee D-1 on Paint, Varnish, Lacquer, and Related Products, D-9 on Electrical Insulating Materials, D-13 on Textile Materials, and D-20 on Plastics.

New Subcommittee. Subcommittee on Classification and Specifications of Rubber Compounds for General Use was organized in view of the expressed need for specifications for rubber compounds for general applications similar to the ASTM-SAE Specifications for Rubber and Synthetic Rubber Compounds for Automotive and Aeronautical Applications (D 735). The latter have been in use for some years quite successfully in the automotive and aeronautical fields.

Subcommittee V on Insulated Wire and Cable presented for committee letter ballot proposed specifications for insulation compounds based on butyl rubber and polyethylene. The general Specifications D 27 for insulated wire and cable are being made more concise by elimination of everything but the physical and electrical requirements. Revisions are also being made in the Tentative Methods of Testing Rubber Insulated Wire and Cable (D 470).

Subcommittee VI on Packings submitted the first proposed Specifications for Sheet Rubber Packings for publication as tentative. These specifications cover sheet rubber packing or gaskets cut from the same, which are intended for general gasket applications on water, air, and low-pressure steam services. They are not intended for use with oils and strong acids. They include compounds manufactured from natural rubber, reclaimed rubber, and synthetic rubber or mixtures thereof. These new specifications will be a companion standard to the present ASTM-SAE Specifications for Non-Metallic Gasket Materials for General Automotive and Aeronautical Purposes (D 1170).

The Section on Relaxation Testing of Gaskets presented a progress report on its interlaboratory test program. These studies of the relaxation test involve accuracy of strain gage readings, rigidity of jigs, timing of load application, scope and size of specimen, etc.

Subcommittee X on Physical Testing of Rubber Products presented a revision in the scope of the Tentative Methods of Sample Preparation for Physical Testing of Rubber Products (D 15). This change of the scope concerned those sections of the methods dealing with compounding and mixing of standard compounds utilizing standard ingredients. It was reported that the work on methods for measuring mill roll and stock temperatures being made at the National Bureau of Standards was progressing, and a report should be available at the next meeting. The Buffing Survey Task Group presented some interesting data, and after review by the committee it was decided to continue the round-robin testing, after the procedure has been given a statistical review.

Subcommittee XI on Chemical Analysis of Rubber Products presented a revision of the procedures for determination of copper and manganese in crude rubber in the Tentative Methods for Chemical Analysis of Rubber Products (D 297).. A revision of the procedure for analysis of ash in D 297 was also recommended. A summary of results of a partial testing program on analysis of carbon black in rubber compounds was given. It now appears to be possible to plan a shorter program involving not more than two methods. A brief discussion of the possibility of enlarging the usefulness of the Tentative Methods of Identification and Quantitative Analysis of Synthetic Elastomers (D 833) by including improved absorption techniques for identification of elastomers resulted in a subcommittee request for consultation with Committee E-13 on Absorption Spectroscopy regarding the best methods of approach to this problem.

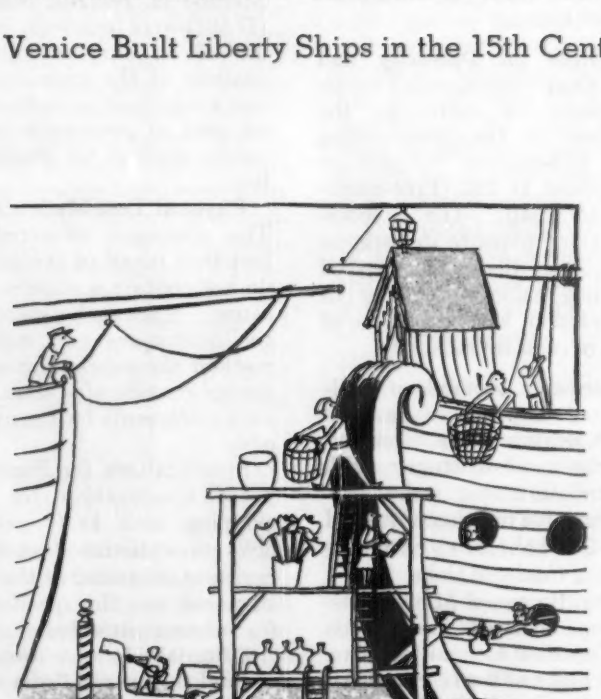
THROUGH HISTORY WITH STANDARDS

How Venice Built Liberty Ships in the 15th Century

Venice, the world's first modern state, apparently created the first true assembly line. Throughout the 15th and 16th centuries, a Venetian water basin, called the Arsenal, which employed 16,000 men and manufactured everything from cannon to nails, was the world's largest industrial plant. There Venice built a standardized trading vessel which could be quickly converted into a galley of war.

When finished, the galley was towed slowly down a canal, and, as it passed, workmen reached out of windows on either side and loaded on its equipment. When the vessel reached the end of the street, every thing necessary was on board, including, cordage, oars, armament food, and a full complement of men.

"In this manner," wrote a Spanish visitor in 1436, "there came out ten galleys fully armed, between the hours of three and nine." In 1570, during the war with the Turks, the Arsenal turned out a hundred fully outfitted galleys in a hundred days.



American Standards Assn.

Subcommittee XII on Crude Natural Rubber at its meeting received from C. C. Miller, secretary of the Crude Rubber Committee of the Rubber Manufacturers Assn., a brief summary of recent work of the RMA Committee. It was voted to set up a task group to study the possibility of developing methods for determining the vulcanization behavior of rubber by means of the Mooney viscometer, with the ultimate view of using data obtained by these means in the classification of crude natural rubber. Considerable discussion took place on the definition of the term "harmful dirt," and it was voted unanimously that it is considered that those particles of dirt in rubber are harmful which do not pass through a No. 325 sieve.

Subcommittee XIV on Abrasion Tests for Rubber Products heard the report that the International Committee ISO/TC 45 has approved standards for the determination of tear and abrasion resistance which will be recommended to the Secretariat of the ISO committee for approval by the member countries. The former is based on the crescent-shaped specimen in ASTM Methods D 624 with a single slit, and the latter is based on the du Pont abrader in ASTM Method D 394 using a constant load. Although the proposed abrasion standard is being submitted for approval, weaknesses have been developed in the standard in that the constant torque procedure has been found to give more consistent results with service and the abrasive and standard compound need better standardization.

Difficulties encountered with the abrasive for use with the du Pont and NBS machine in Method D 394 resulted in the subcommittee deciding to circulate a questionnaire to obtain information with respect to the needs and difficulties being encountered. Also the ISO/TC 45 program for standardizing the abrasive for the du Pont machine will be closely followed and the subject will be again considered at the June meeting.

Since the standard compounds in Method D 394 only cover natural rubber, a revision of this standard will be prepared which will include the synthetic rubber-carbon black compounds now in Method D 15. Requirements for control of the air pressure at 40 ± 5 psi for cleaning the abrasive in Method B will also be included.

A revision for immediate adoption was recommended in the Standard Methods of Test for Tear Resistance of Vulcanized Rubber (D 624) which will clarify the procedure for measuring the thickness of the specimens in the tear test.

Subcommittee XV on Life Test for Rubber Products reviewed at length recommendations pertaining to oven and oxygen-bomb aging tests received from ISO/TC 45. Comments will be submitted to the ISO committee. A task group was appointed to determine the possibility of use of a triangular strip in sunlight aging. The ambient temperature of artificial weathering machines is being defined, as well as a method for measuring it.

Subcommittee XVII on Hardness, Set, and Creep appointed a task group to study the relationship between the durometer hardness Method D 676 and the ISO method and to consider the possibility or advisability of adopting the ISO standard for hardness of rubber. It was also decided to investigate the effect of 1 to 30 sec readings with the "Wallace hand test instrument" as compared to the "ISO dead weight instrument."

Subcommittee XX on Adhesion Tests has in process a round-robin study of the Tentative Methods of Test for Adhesion of Vulcanized Rubber to Metal (D 429) in order to determine the relative merits of certain proposed changes in Method A for testing rubber parts assembled between two parallel metal plates and for Method B for testing rubber assembled to one metal plate. Study of Method B is to be given preference with one laboratory preparing all assemblies and six laboratories participating in the testing of the prepared samples. Consideration was given to methods for testing rubber-to-metal bonds under dynamic conditions. A summary of dynamic test methods now in use in the industry will be prepared and studied prior to the next meeting.

Subcommittee XXI on Rubber Cements recommended the addition of an explanatory note in connection with the flow test described in the Tentative Methods of Testing Adhesives for Brake Lining and Other Friction Materials (D 1205) to read as follows: "Percentage of flow is influenced by composition of the material, thickness of the film, and the rate of temperature rise of the oven." A bend test for friction materials bonded to metal was described, including pictures and blueprints of the test equipment which will be written up for consideration at the next meeting. It was suggested that study might be made of the problems of predicting shelf life of neoprene cements to be used in place of the time-consuming aging test now in use. Laboratory test data are being accumulated for evaluation of an impact test and it is hoped that draft of a method may be ready for consideration at the next meeting.

Subcommittee XXIII on Hard Rubber has been actively studying an alternative impact test for inclusion in the Tentative Methods of Testing Hard Rubber Products (D 530). In this connection there was presented at the meeting a report on "controllable variables in the ball drop impact test." Study is also being made of an impact test for inclusion in the Tentative Methods of Testing Asphalt Composition Battery Containers (D 639). A report was presented of analytical results on the determination of soluble iron in hard rubber compositions. This proposed method will be given further study by the committee. Action was taken to submit to letter ballot a recommendation to replace the softening point procedure in Method D 430 by the test now included in Method D 648. A report was presented on tests now being conducted on the extensometer method for measuring the "elongation" of hard rubber. Very satisfactory results are being obtained.

Subcommittee XXV on Low-Temperature Tests submitted a revision in the Tentative Method of Test for Low-Temperature Brittleness of Rubber and Rubber-Like Materials (D 736) in order that it will conform with Specifications D 735 as to testing temperature and also not to limit the method to any specific test temperatures. The revision involves the deletion of the requirement that "Standard test temperatures shall be −40 F and −70 F" and the substitution of a note to read "Temperatures of −40 F and −65 F are commonly used." The temperature-retraction test is now ready for letter ballot in the main committee.

Subcommittee XXVI on Processibility Tests reviewed the progress on the investigation of the new type dies and rotor by the Mooney viscometer in the Tentative Method of Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer (D 927) which have been reported upon by the National Bureau of Standards.

The SAE-ASTM Technical Committee on Automotive Rubber presented the following summary of its work and actions taken at the last two meetings held in September and December, 1953.

Section I on Vibration Insulators has completed a round-robin test program to determine the reproducibility of the Tentative Recommended Practice for Classifying Elastomeric Compositions for Resilient Automotive Mountings (D 1207). The data are now being compiled.

Section III on Automotive Hose prepared a revision of the SAE Specifications 40-R3 and also the ASTM Methods D 622 to provide for light-duty vacuum brake hose and methods of testing.

Section IV prepared revisions covering Suffix Letter L in the Specifications for Rubber and Synthetic Rubber Compounds for Automotive and Aeronautical Applications (D 735) which have been approved. It has recommended a revision of Suffix Letter K which is to be divided into K_1 adhesion of rubber to metal during vulcanization, and K_2, adhesion of rubber to itself or other material.

Section X on Gaskets is considering further revisions in SAE 90R and ASTM Tentative Specifications D 1170. The Section on Oil Seals has recommended that the bench leakage qualification test be changed from 500 hr to 236 hr and this has been approved.

The Section on Finish Standards is making some progress on a system of indicating by means of standard notes on blueprints, the type of finish required for molded and extruded rubber articles. This work is still in progress.

D-16 Industrial Aromatic Hydrocarbons

With the aim of establishing recognized standards that will be of value to both consumers and producers, the committee is actively engaged in preparing test methods such as the following: for phenol-solidification point, water content, color, water solubility. For naphthalene-solidification point, acid wash test, color. For pyridine-distillation range, water content, color, oil content. For quinoline - distillation range, water content, oil content, solidification point.

If further consumer interest develops, such as on the part of the pharmaceutical industry, the committee is prepared to investigate other test methods for the products listed.

Additions and revisions are also under way with respect to existing ASTM Standards covering benzene, toluene, xylene, and solvent naphtha. This includes work on a bromine index method to determine saturates in benzene, and further work on improvement of the method for determining thiophene content of benzene. In addition, an attempt is being made to correlate and ultimately eliminate differences between distillation by Method D 1078, as used by solvent consumers, and Method D 850, traditionally used by the producers of the above aromatic hydrocarbons.

D-19 Industrial Water

With nearly all of the 2500 copies of the first printing of the Manual on Industrial Water already sold, Committee D-19 completed arrangements for a second printing which will include a detailed index and all new and revised D-19 standards accepted in 1953.

The committee approved for letter ballot a revision of the Method of Reporting Results of Analysis of Industrial Water (D 596) to include specific requirements for reporting results for industrial waste water. Also approved for committee letter ballot were revisions of the Methods of Sampling Industrial Water (D 510) and Steam (D 1066) so that both methods will cover sampling at subatmospheric pressure.

The committee plans to submit to the Society in June, revisions of the following two methods of test: a complete revision of the Method of Test for Carbon Dioxide (D 513), and an extensive revision of the Methods of Test for Suspended and Dissolved Solids in Industrial Water (D 1069) to provide methods for both industrial water and industrial waste water. The committee also took action to ballot on a proposed new tentative method for flame photometric determination of sodium and potassium. Studies of optical methods for turbidity in water have been begun with the object of developing an ASTM method for this determination. The task group on dissolved oxygen (responsible for Methods D 888) made arrangements for another clinic to be held in the field for evaluation of the accuracy of the various oxygen methods. Round-robin tests are now under way on methods for chemical analysis of water-formed deposits.

The committee has nearly completed preparation of simplified methods of test for hardness, hydroxide, nitrite, and sulfite in industrial water which are to be recommended to The American Society of Mechanical Engineers for inclusion in the ASME Boiler Test Code, in the section on care of power boilers.

In addition to the methods of analysis just mentioned, a new method of test for thickness of water-formed deposits was approved for letter ballot. New projects were initiated on the application of radioactive isotope tracer measurements to industrial water and industrial waste water problems, and on methods for performance testing of resin ion-exchange materials for industrial water treatment.

Specifically in the field of industrial waste water, the committee will ballot on a proposed tentative method of determination of oily matter. A proposed method for toxicity to aquatic life was approved for publication as information only. Work has been started on methods for sampling and gaging of industrial waste water.

D-21 Wax Polishes

Committee D-21 and all of its subcommittees met on February 4 and 5.

Subcommittee IV on Performance Tests has concluded a significant contribution to flooring slipperiness testing with the publication as information of two proposed methods of measuring the static and dynamic coefficient of friction of waxed floor surfaces in the February ASTM BULLETIN. The subcommittee discussed these methods and recommended the use of a ground-glass plate as a standard flooring surface sample in preference to the tentative official test linoleum (TOTL) now under consideration. Work is now nearing completion on the test method for water spotting and methods of applying wax films.

Subcommittee II on Raw Materials reported that two proposed methods will be published as information in the ASTM BULLETIN (see page 38 of this issue): a suggested method of test for concentrating additives of waxes, and a suggested method of test for the index of refraction of carnauba wax and other high melting point natural and synthetic waxes. The chromatographic method for the determination of paraffin in waxes was discussed and a draft of procedure is now reaching completion. New work under way includes the development of methods for determining sap number and acid number of waxes. Ester and acid determination of waxes are presently under discussion.

Subcommittee III on Chemical and Physical Testing reported that considerable work has been accomplished on the Pensky-Martens tester as used for testing the flash point of wax emulsions. Study of the stability or shelf life of packaged waxes is now under consideration.

Subcommittee V on Specifications has completed an outline of a general

type of specification covering the properties of water-emulsion floor waxes which may be defined by various test methods and included in a specification. A recommended practice for maintaining industrial tile and mastic floors was presented and it was announced that a recommended practice for maintaining installations of linoleum was being prepared.

E-1 Methods of Testing

There were meetings of 14 subcommittees and task groups of Committee E-1.

The organization meeting of a new Subcommittee on Bend Testing was held under the chairmanship of W. H. Mayo, United States Steel Corp. An extensive review of the various types of bend tests now specified in ASTM Standards was presented to the committee. The summary in Table I shows that there are 151 bend test procedures now specified; of these, 137 are for testing metals, while 14 are for nonmetallic materials.

TABLE I.—SUMMARY OF TYPES OF BEND TESTS SPECIFIED IN ASTM STANDARDS.

	Material			
	Ferrous	Non-Ferrous	Nonmetals	Total
Free 180 deg	43	8	1	52
Pin 180 deg	24	4	1	29
Other pin	16	1	1	18
Hot bend	4	1	5	10
Nick bend	7	..	..	7
Coatings	3	1	..	4
Special	4	..	2	6
Guided or jig	5	2	1	8
Reverse in jig	1	1	..	2
Mandrel or wrap	11	1	3	15
Total	118	19	14	151

The committee decided to undertake work on: (1) correlation of bend tests now published and consideration of possible further improvement and standardization, (2) investigation of present bend test methods for possible new applications, and (3) development of new bend test methods where needed. In connection with this program, the subcommittee decided to proceed immediately with the preparation of a set of definitions covering the various types of bend tests now in use, such as the free bend, controlled bend, guided bend, bending around a pin, etc.

Subcommittee 3 on Elastic Strength of Materials received an extensive and interesting progress report from its Task Group on Review of Definitions. This task group during the past year has made a comprehensive study of 17 definitions of terms relating to mechanical testing. These cover the following:

Stress	Compressive Strength
Strain	Shear Strength
Stress-Strain Diagram	Modulus of Elasticity
Elastic Limit	Elongation
Proportional Limit	Reduction of Area
Yield Point	Indentation Hardness
Yield Strength	Brinell Hardness Number
Tensile Strength	Rockwell Hardness Number
	Diamond Pyramid Hardness Number

The committee has been reviewing these definitions as applied to both metals and nonmetals. Discussion at the meeting, however, indicated that as the first step in this program it may be necessary to consider the definitions from the viewpoint of their application to structural materials with the understanding that, later, attention would be given to expanding them to cover uses in connection with other materials. When completed, these definitions will be submitted as a revision and replacement of the present Standard Definition of Terms Relating to Methods of Mechanical Testing (E 6).

The Task Group on Elastic Constants considered the first draft of a proposed method for determination of Young's modulus for metals at room temperature. Included in this first draft was a discussion of the following general provisions and consideration necessary in determining Young's modulus: "The precision desired in determinations of Young's modulus is usually of a higher order than that required in other tests. The over-all precision may be of the order of the tolerance permitted in a single variable in other tests. Furthermore, there are more variables likely to have a significant effect in determinations of Young's modulus. The relative importance of these variables may depend upon the material, the exigencies of testing, and the purpose for which the value is to be used. Some of the most important variables are accuracy of load, accuracy of extensometer, orientation of crystals, residual stress, previous strain history, dimensions of specimen, eccentricity of specimen, condition of testing equipment, alignment of specimen, speed of testing, temperature, temperature variation, interpretation of data, stress range, and strain range.

Subcommittee 2 on Effect of Speed of Testing had received progress reports on the following subjects: (1) bibliography, (2) metallic materials, (3) nonmetallic materials, and (4) testing machines and speed control equipment.

A wealth of information had been collected by members of the task group on the effect of speed of testing of nonmetallic materials. The committee believes that it would be desirable to make this information available in published form. The data and descriptive material are of such a nature that it was felt it might serve as a nucleus for a symposium on the effect of speed of testing of nonmetallic materials which may be sponsored at an Annual Meeting of the Society, possibly in 1955.

Subcommittee 7 on Impact Testing considered revisions of the Tentative Methods of Impact Testing of Metallic Materials (E 23). Agreement was reached on a number of important changes in the methods which will be subject to letter ballot approval of the subcommittee. Plans were considered for the Symposium on Impact Testing to be sponsored by this subcommittee at the 1955 Annual Meeting of the Society. This Symposium will be rather broad in scope and will cover (1) redefinition of the notched-bar impact test with related methodology and geometry, including information on the reproducibility of specimens and reproducibility of results, and (2) impact testing and failure of parts and structures, and the significance of tests. The description of the impact test in the ASTM Tentative Methods and Definitions for the Mechanical Testing of Steel Products (A 370), which have been prepared by Committee A-1 on Steel, will be reviewed and comments submitted to Committee A-1 for consideration.

Subcommittee 4 on Tension Testing acted to submit to letter ballot vote a revision of the Tentative Methods of Tension Testing of Metallic Materials (E 8) to include detailed descriptions of two tension test specimens for powdered metals which have been recommended by Committee B-9 on Metal Powders and Metal Powder Products. One specimen is a flat unmachined tension test bar with a 1-in. gage length and the second specimen is a round machined test bar with 1-in. gage length for testing powdered metals.

The Tentative Methods and Definitions for the Mechanical Testing of Steel Products (A 370), prepared by Committee A-1 on Steel, include descriptions of tension test procedures for production testing. A task group will be appointed to review the tension testing features of Methods A 370.

Subcommittee 6 on Indentation Hardness reported approval by letter ballot vote of revisions in the Tentative Method of Test for Brinell Hardness of Metallic Materials (E 10). This revision will add a statement to the scope pointing out that these procedures for Brinell Hardness testing of metallic materials are intended for use where a high degree of accuracy is required. Action was also taken recommending the adoption as standard of the Tentative Method for Diamond Pyramid Hardness of Metallic Materials (E 92).

Revisions in the Standard Methods of Test for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials (E 18) have been approved by letter ballot vote of the subcommittee and will be submitted to the Society in June. These revisions cover changes regarding the major load application; also an appendix will be added to the methods comprising two tables of calculations, one set of corrections to be added to Rockwell C, A, and D values obtained on cylindrical specimens of various diameters. The other table covers corrections to be added to Rockwell 15 N, 30 N, and 45 N values obtained on cylindrical specimens of various diameters.

The Task Group on Laboratory Ovens gave consideration to Proposed Tentative Specifications and Methods of Test for Circulating Air Ovens. Data submitted by various members on temperature distribution were reviewed by the committee. This new specification, when completed, will be a companion standard to the present Tentative Specifications for Cell-Type Oven with Controlled Rates of Ventilation (E 95).

The United States has been assigned the Secretariat for the International Committee ISO/TC 66 on Determination of Viscosity. An organization meeting of the American Group to handle the Secretariat was held on February 3. Other active participating countries are Denmark, France, Germany, Netherland, Sweden, and the United Kingdom, and, in addition, 16 countries are participating as observers. The provisional scope of this committee is (1) establishment of reference standards for absolute viscometry, and (2) standardization of apparatus and procedures for measuring absolute viscosity. Detailed information was presented on the API viscosity standards distributed by the American Petroleum Institute for use as reference materials in the calibration of kinematic viscometers. Similar information was also presented on the NBS liquid viscosity standards established by the National Bureau of Standards.

Action was taken on several proposals to be submitted to the ISO committee. The new value for the viscosity of water of 1.002 poises at 20 C was recommended for adoption. Action also was taken to submit to the member countries copies of the "Report on the Principles Involved in the Determination of Absolute Viscosity." This report was prepared in 1951 by Subcommittee 9 on Rheological Properties.

Action was taken to submit to the ISO committee detailed information on viscosity standard samples that are available in the United States.

It was announced that a Symposium on Viscosity was being planned for the 1955 ASTM Annual Meeting, under the sponsorship of Subcommittee 9.

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To the ASTM Committee on Membership,
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Gentlemen:

Please send membership information to the company or individual indicated below:

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This company or individual is interested in the following subjects: indicate field of activity, that is, petroleum, steels, non-ferrous, etc.

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Signed _____

Date _____ **Address** _____

Subcommittee 27 on Low-Temperature Testing of Elastomers and Plastics received at its meeting a progress report from the Task Group on Correlation of Test Methods. This included an extensive summary of information on the stiffness and hardness tests at low temperatures which is being prepared for publication. The latest recommendations regarding organization of the brittleness and stress-relaxation round-robin test program were considered. A report was also received from the Task Group on Correlation of Bureau of Ships Reports. This included information on the statistical coverage formula for converting hardness readings from one instrument to another, such as the Shore, Rex, Olsen, and Pusey & Jones apparatus.

E-4 Metallography

During Committee Week some very definite decisions were made concerning the correction and unification of the several existing methods of grain size determination. A number of relatively simple, but effective, changes were proposed for E 91, Method for Estimating the Average Grain Size of Non-Ferrous Metals, Other Than Copper, and Their Alloys. It is expected that these changes will receive full committee approval before June and that Method E 91 will then be adequate for all non-ferrous grain size requirements.

Part I of a comprehensive, two-part revision of E 43, Recommended Practice for Identification of Crystalline Materials by the Hanawalt X-Ray Diffraction Method, was given a critical review. A second draft will be available for further appraisal before June.

A reorganization of Subcommittee XI, Electron Microstructure of Steel was planned and approved. Henceforth Subcommittee XI will be known as Subcommittee XI, Electron Microstructure of Metals, with two subdivisions, one working with the Electron Microstructure of Steel and the other working with the Electron Microstructure of Non-Ferrous Metals.

E-5 Fire Tests of Materials and Construction

Very encouraging progress was reported on the special research project for development of small-funnel test equipment. Associations representing six materials groups have contributed to the fund, in addition to the Forest Products Laboratory, where this research is being conducted. It is expected that tests will be run as part of this project to correlate data on the small type equipment with the larger Underwriters' Laboratory equipment. Consideration will be given also to humidity conditions and to sampling.

Tentative revisions of the Standard Methods of Fire Tests of Building Construction and Materials (E 119) were accepted, covering the addition of a paragraph in the introductory section discussing the behavior of materials during the test; the location of thermocouples and increasing the total to nine. Existing tentative revisions of this standard, which were approved for adoption as standard, include the addition to Table I of a "less than one hour" classification and the deletion of Paragraph 26(*b*) dealing with the hose stream test.

A proposed method of test for roof coverings is being held in abeyance, pending a study to be submitted by the Asphalt Roofing Industry Board. The Tentative Method of Fire Hazard Classification of Building Materials (E 84T) was approved for adoption as standard. Much discussion took place on the use of the term "incombustible" as compared with "noncombustible." A proposed method of defining noncombustibility of building materials was approved for circulation to the committee for further consideration at a later meeting.

E-9 Fatigue

The committee this year, as in the past, has continued to stimulate offers of papers for presentation before the Society at the Annual Meeting in June. Thirteen papers have already been submitted in the fatigue field dealing with such phases of this important question as fatigue theory, prediction of life, metallographic aspects, a new type testing machine, and relation of fatigue loads to the softening of certain cold-worked metals.

The "References on Fatigue" have appeared annually since 1951 and each year include brief abstracts of fatigue papers published during the previous year. A brief index to accompany the references is one change proposed for the current as well as future editions. Copies of this latest issue of "References on Fatigue," *ASTM STP No. 9-E*, will be available early in the Summer. Some consideration is being given to publishing the individual references in the form of punch cards, and comments as to the desirability of such a procedure would be appreciated by the committee.

A task group on statistical methods is actively engaged in preparing recommended methods for conducting fatigue tests with particular reference to statistical control.

E-12 Appearance

The major feature of the meeting of Committee E-12 was its Symposium on Color of Transparent, Translucent Products. The symposium revealed areas where problems of appearance exist, and in importance large enough to justify research effort to find solutions. Such areas were shown to vary widely from one industry to another, but the intensity of research efforts also varies widely. Color grading of agricultural products, in particular, seems to be expanding most rapidly and is assuming large dollar value. The development of color control methods in other industries, such as brewing, glass, and plastics has already reached somewhat higher levels.

In addition to the main committee, meetings were also held of the four subcommittees as follows: I on Definitions, II on Color and Spectral Characteristics, III on Gloss and Geometric Characteristics, and IV on Pictorial Representation.

Subcommittees II and III collaborated in presenting suggested drafts for the following: (1) Suggested

Work on Electron Microstructure Expanded

Committee E-4 on Metallography wishes to announce a change in the scope and organization of Subcommittee XI on Electron Microstructure of Steel. Up to the present, this group has limited its activities to the electron metallography of steel. It is planned to widen the scope to include all metals and, accordingly, the name has been changed to Subcommittee XI on Electron Microstructure of Metals. The organization has also been modified: the original work of the group will continue in the Subgroup on Electron Microstructure of Steel, and a new Subgroup on Electron Microstructure of Non-Ferrous Metals will be organized.

As in the past, membership in Subcommittee XI signifies active participation in the cooperative investigations of the group. Inquiries concerning the extended program may be directed to the Chairman of Subcommittee XI, W. L. Grube, General Motors Research Division, Detroit 2, Mich.

Method for Goniophotometry (Angular Light Reflectance and Transmittance) of Objects and Materials, and (2) Suggested Terminology and Geometric Conditions of Measurement for Light Reflectance and Transmittance of Objects and Materials.

Goniophotometry is used to measure the geometric manners in which objects and materials distribute the light reflected and transmitted by them. The geometric manners in which objects and materials reflect and transmit light are responsible for their glossiness and diffuseness by reflection, and for their transparency, haze, and turbidity by transmission. The relation of goniophotometry to gloss, haze, and other appearance attributes is analogous to the relation between spectrophotometry and color. In the case of geometry selectivity, there are at present no unique procedures (as for color) to convert goniophotometric curves to corresponding appearance factors. Diffuseness, whether by reflection or transmission, results from more or less uniform distribution of light in all directions while glossiness, seen by reflection, and transparency, seen by transmission, result from concentrated projection of light in the respective directions of mirror reflection and direct transmission.

In addition to measurements of attributes responsible for appearance, goniophotometric measurements by reflection are used for studies of surface structure, surface attack, and other phenomena. Transmission measurements are used for studies of solids in suspension, light-spreading properties of materials used in lighting units, etc. The suggested method is intended primarily for research work. Goniophotometric curves are generally used as guides for designing simple methods for measurement of gloss, haze, or transparency of specific types of materials.

The proposed terminology is intended as a guide for the selection of terms, measurement scales, and instruments for describing the capacities of objects and materials to reflect and transmit light. It deals only with geometric aspects of reflectance and transmittance which are associated appearancewise with gloss, lightness, transparency, haziness, turbidity, and the like. It does not deal with the spectral factors that are associated with color. For the spectral characteristics and color of objects and materials, reference should be made to the ASTM Methods of Test for Spectral Characteristics and Color of Objects and Materials (D 307) and Method of Test for Luminous Reflectance, Transmittance and Color of Materials (D 791).

Notes on Use of the X-Ray Index

F. W. Matthews, Canadian Industries Ltd., long-time member of the Joint Committee on Chemical Analysis by Powder Diffraction Methods, has prepared a guide to the use of the ASTM X-ray Index which is now available and is described on page 8 with prices.

IDENTIFICATION by means of an X-ray diffraction powder pattern is dependent on established data previously determined on a given substance; a compilation of known data properly indexed is therefore essential to the use of the method. The index published by the Society on behalf of the Joint Committee is an attempt to gather data from the literature and private sources and to present these data in the most convenient form for efficient chemical identification.

The basis of the method was established by Hull (6) and by Hanawalt and Rinn of the Dow Chemical Co. (4,5). These papers should be read by all users of the method.

A description of the card and the format used is given in the foreword which accompanies the index. These notes are intended as a further guide to its use.

The Book Index will be the usual approach to the system. In large laboratories, the usefulness of the index may be increased by the addition of extra copies of this book which are available at a nominal cost. In this book the numerical listings follow the system devised by Hanawalt and Rinn (4). Each substance is listed according to the following permutations of the three strongest lines: (*1*) strongest, second strongest, (*2*) second strongest, strongest, (*3*) third strongest, strongest. Other methods of listing have been examined but these are considered to be the most useful of the six possible permutations of two out of three. The primary reason for the second and third listings is for those cases where the strongest line of one component of a mixture is obscured by a line of a component already identified and the anomalously high intensity of this line has not been recognized. By convention, when two lines have the same intensity the one with the longer "d" spacing is considered the stronger. As received, the cards are arranged in groups determined by the strongest line of a pattern. Within the group the order is that of the second strongest line. This arrangement, which is also followed in the index book, is referred to as the "Hanawalt group" system. The range of the various groups is given in the foreword to the cards.

In using the book it is usual to start with the two strongest lines of an unknown pattern. The strongest will determine the group and the second strongest the location within the group. If the unknown data correspond to one of the three listings of a compound in the index, this should refer one to the card giving the complete data. However if a satisfactory match is not found another combination of the strong lines of the pattern should be tried. In a comprehensive search it is often useful to go to the group determined by a strong line of the unknown pattern and to check every other major line of the unknown for a possible match. This will be particularly helpful if the unknown is a mixture and the strongest lines belong to separate components. For the final identification, the card referred to in the index must be used and a full check made of the data with the unknown. The index card is, however, only a substitute for a pattern of the authentic compound taken with the same technique as the unknown. A real attempt should be made to complete an identification in this way. A file of standards is a very valuable asset in all identification work and anyone planning extensive use of this method should set up a well indexed file of reference patterns.

When the unknown pattern represents a mixture rather than a single phase, the problem of identification is more difficult. If one pattern has been identified it is usual to mark the lines of that pattern watching for abnormal intensities which may indicate a superposition of reflections. The search is then continued with the remaining reflections. It is usually wise to attempt a separation into components making use of optical or magnetic properties and possibly particle size. It may be necessary to make use of differences in solubility. The technique of the microchemist and microscopist are most useful in this work. A low-power microscope fitted with polaroid disks is helpful in mechanically separating crystals on the basis of optical properties.[1] Ignition in air or vacuum will often convert an unknown into a phase which can be identi-

[1] A. F. Kirkpatrick, Polarizing Attachment for Microscopes, U. S. Patent No. 2,624,236, 1953.

fied. This then gives a lead to the identity of the original. When there is an appreciable difference in the crystallite size of two compounds of a mixture, this will often show up as a difference in texture of the lines of a diffraction photograph. This can be accentuated by running a pattern with the specimen stationary in the powder camera.

As an aid to identification, a knowledge of the chemical composition of the unknown is helpful. In the case of inorganic compounds, the identity of metallic elements present is of great assistance in searching the index, for watch is kept on the chemical formulae column for the elements known to be present. Such information as, for example, that the sample came from a water solution and therefore may be a hydrate, or, the material has been heated and is therefore probably not a hydrate, is a valuable lead to be kept in mind while making a search.

In any event, it is always wise to confirm the presence of a major element before completing the identification, if only by a quick qualitative chemical test. In many laboratories the use of the emission spectrograph on unknowns is routine before proceeding to X-ray diffraction examination. To emphasize this point, one should compare the powder patterns of calcium fluoride (CaF_2) and silicon metal, or of quartz and ortho aluminum phosphate.

The searching of the index for the identification of an unknown becomes most tedious and time-consuming, particularly when no match is found and an exhaustive search is required to be fairly certain that the pattern does not correspond to one in the index. For such work the mechanical searching offered by the Keysort cards (7) and the IBM index (8) is useful. Both methods allow qualitative chemical analysis to be combined with the search based on strongest diffraction lines. For instance if one knows that the unknown is a lead compound, the cards of all substances containing lead can be readily separated from the others. This is perhaps the most frequently used feature of these methods. Both use the Hanawalt group system whereby there are three cards for each pattern and the cards are separated into Hanawalt groups as in the Index Book. The Keysort cards allow six permutations of two of the three strongest lines to be searched using a single Hanawalt group of cards. The IBM system offers the same possibilities and has also listed the ten strongest lines and a more complete chemical classification. Both methods are being usefully applied in industrial and university laboratories. Full description of these cards and the codes employed are available as separate publications (7, 8).

For the identification of patterns for which no match can be found in the index, methods based on identification of the typical structure have been devised by L. Frevel. To date the cubic tetragonal and hexagonal substances have been covered by this method (1, 2, 3).

The present index is a compilation of data taken from the literature and from many private sources. The original index consisting mainly of the data published by Hanawalt, Rinn, and Frevel (5) gave the X-ray diffraction powder data for 1000 compounds, all taken with the same equipment and with uniform methods for preparing and recording those data. Additions to the index have come from a wide variety of sources and hence the quality is no longer uniform. This is particularly true with respect to intensities which are influenced by many factors. When the literature has given intensities as VS, S, MW, etc., the data have arbitrarily been assigned intensity values which end in zero. Some of these relative intensities may be in error as much as tenfold. For example, compare the two cards in the file for $CdCO_3$ (2.94, 1.83, 3.78 and 2.49, 3.77, 1.83) or for $AgNO_2$ (3.08, 2.11, 1.97 and 3 06, 3.95, 1.97).

It has been the policy to include as much information as possible, as it is more useful to have data of perhaps doubtful quality on a given compound rather than no data at all. As improved information becomes available, either in the literature, from private sources, or from a project set up at the National Bureau of Standards for the purpose, the poorer data are being replaced in the index.

The non-uniform quality of the information in the index places some restrictions on its use, as the possibility of errors of identity and transcription in such a compilation is always present. It does not, however, suggest that the user need not be careful in preparing data from an unknown. It is always true that the more accurately the "d" spacings and the relative intensities are determined the quicker and the more certain the identification becomes.

There is a reference on each card which states the source of the data. In the case of published data this may give additional information on the problem and may prove helpful for its evaluation by the user. Data prepared by the National Bureau of Standards have been marked with a star.

The growth of the index is dependent on new data, and users of this index are urged to prepare the powder diffraction data on new substances or improved data on substances already listed. Similarly, when errors are found these also should be drawn to the attention of the editors. All new data and note of errors should be sent either to: Prof. W. P. Davey, Pennsylvania State University, State College, Pa., or Prof. A. J. C. Wilson, Department of Physics, Cardiff University, Cardiff, Wales.

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(1) L. K. Frevel, "Tabulated Diffraction Data for Cubic Isomorphs," *Industrial and Engineering Chemistry, Analytical Ed.*, Vol. 14, 687 (1942).

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SPEAKER'S DELIGHT

WITH the possible exception of an electronic hook to remove boring speakers, the auditorium at the General Electric Research Laboratory is equipped with every conceivable device for successful speachmaking.

Before his talk the speaker is provided with a vest pocket combination microphone and FM broadcasting unit which transmits to a recording booth in the rear of the auditorium. If the speaker is of the strolling type who likes a lot of room to talk in, the microphone will pick up his speech whether he stays near the rostrum or not. His remarks are then relayed to a tape recorder by an FM receiver.

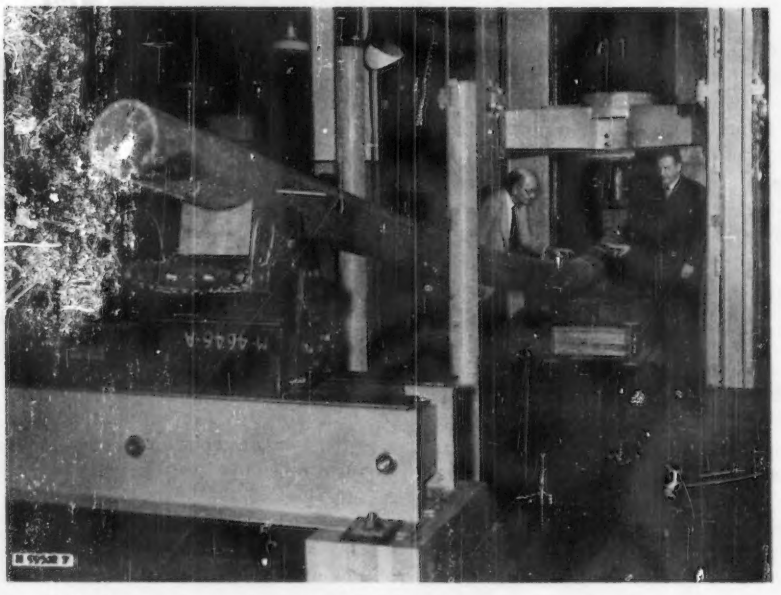
For slide lectures, the speaker may squeeze a pistol-grip selector to operate either of two slide projectors.

But woe betide the man who talks too much! A clock at the rear of the room turns green as his time limit nears. If he persists, the clock face turns bright red and blinks angrily until the peroration is over.

—*G.E. News Digest*

ASTM Wood Pole Research Program

Large Savings Expected from $150,000 Project



ASTM Wood Pole Research Program gets under way. R. P. A. Johnson and L. J. Markwardt examine a western larch pole showing deflection at maximum load.

THE two-year research program expected to save industrial users millions of dollars in pole costs by establishing more precisely the breaking strength of wood poles has been started at the U. S. Forest Products Laboratory, Madison, Wis. The first pole, a 30-ft, class 6, western larch, was tested on February 4. A fund of $150,000 is being raised to finance the work; and industries producing, treating, and using poles have already pledged or allotted sufficient funds to justify the inauguration of the project. Thus far, contributions for the first year's work have been received from over 50 interested organizations, and the number is continually growing as the importance of the program becomes more widely recognized.

The research program described in the May 1953 BULLETIN has been under development for several years and is sponsored by ASTM Committee D-7 on Wood, of which L. J. Markwardt is chairman, with the close cooperation of various interested agencies. As now planned, tests will be made on about 600 full-sized poles of different species, and on some 15,000 small specimens taken from the poles to determine the quality of the clear wood. The research is designed to replace existing inadequate and conflicting data on pole strength with a solid basis of technical information for revised specifications.

Program Objectives

Objectives of the program are:

1. More accurate pole design standards.
2. Greater assurance of getting poles that are strong enough at reasonable cost.
3. New information on the effect of preservatives on pole strength.
4. Better specifications that establish accurate relationships among different species.
5. Substantial savings to buyers and processors of poles.

Data now in use are considered contradictory and unreliable. Inconsistencies penalize buyers in two ways. With some species, the buyer may be paying for unneeded strength, while with others he may not be getting adequately strong poles and, as a result, has inordinately high maintenance costs.

Allowable stresses on species used for many years were originally developed from assumed values known to be safe and published in early editions of the National Electrical Safety Code. These assumed values did not recognize inherent strength differences among species, however, and consequently the allowable stresses were gradually increased as field experience was gained and breaking tests were made on full-length poles. Inadequate test controls, however, have resulted in inconclusive and sometimes misleading data.

Tests on 600 Poles

The research includes tests on about 600 full-size poles of western red cedar, Douglas fir, lodgepole pine, loblolly pine, longleaf pine, short-leaf pine, slash pine, and western larch, all collected in the woods and authentically identified as to species. Supplementary tests will be made on small, clear specimens cut from each pole, in order to relate the results with those of the full-size pole tests. Such a relationship should facilitate quick, low-cost rating of new species in the future by means of economical tests on small specimens.

In developing the proposed program, the committee first investigated methods of testing full-length poles and adopted two standard test methods. One, the crib test, simulates conditions. The other, the machine test, is cheaper, less cumbersome, and more accurate and should give as good if not better information.

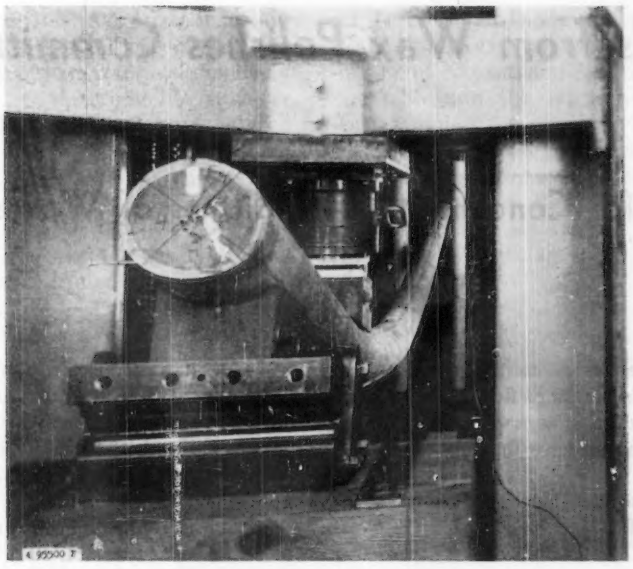
The first step will be to correlate the two methods of test, controlling and recording such major variables as density, species, major defects, and moisture content, and averaging uncontrollable variables by testing a sufficient number of poles. With the desired correlation established, tests can be concluded by the cheaper method.

Treated and Untreated Poles Tested

The second step in the program is the determination of the basic strength of untreated poles, or poles "in the white" for various species. This is necessary because a base is required to determine the effect of various treatments and treating conditions upon the strength of poles of various species.

The third step will consist of tests of treated poles. Each species tested will be given a type of treatment permitted by the treating specifications for that species and used in current commercial practice. In all of the testing, major controllable variables in the pole timber will be controlled and their effect upon the pole strength determined. Uncontrollable variables will be evaluated to the extent possible within the limits of the money available.

An important and what should prove to be a valuable result of this program will be a more precise correlation between the moduli of rupture of small



This is the first western larch pole tested. Tension failure at maximum load may be observed.

clear specimens and the strength of a pole. In the future, this should save the industry considerable money in investigating new species, new treatments, new preservatives, and different treating conditions, since the necessary information can be obtained by testing small clear specimens instead of full-sized poles.

This program, it is believed, will give pole purchasers greater assurance that poles have adequate strength and in many cases will save them money. A threefold saving can result: first, in the cost of the pole in the white; second, in the cost of preservative; and third, in freight. Since freight is a large part of the cost of poles, this saving is substantial as well as automatic.

One species of poles that is rated on the historical basis is reported to represent 75 per cent of the pole usage, and if the test program provides data justifying the uprating of poles of this species, the savings to the purchasers could amount to millions of dollars annually.

Contributions Solicited

Contributions for underwriting the cost of this investigation are being solicited by the ASTM through a Ways and Means Committee headed by Col. L. G. Smith, Consolidated Gas, Light and Power Co., Baltimore, Md. Substantial funds have already been received or allocated from individual companies and associations of pole producers, pole processors and treaters, pole users, including the American Telephone and Telegraph Co., the United States Independent Telephone Assn., the Rural Electrification Administration, and the Forest Products Laboratory.

For those who desire to contribute to the program, checks may be sent to the Treasurer, ASTM, 1916 Race St., Philadelphia 3, Pa. Checks should be drawn to the order of "ASTM Wood Pole Research Program."

Symposium on Industrial Hygiene Instrumentation

THE University of Michigan in conjunction with the Institute of Industrial Health and the School of Public Health will hold a Symposium on Instrumentation, May 24 to 27, in which 30 papers on instrumentation for industrial hygiene will be presented.

It is expected that the symposium will bring together manufacturers and users to exchange information on what is needed in the field of instrumentation for air velocity, air pollution, ionizing radiation, sound, and air sampling and analysis.

About 100 manufacturers will participate in an exhibit and will also act as special faculty members during the week.

Those interested in obtaining further information, should write to: Director, Continued Education, 109 S. Observatory St., Ann Arbor, Mich.

Calendar of Other Societies' Events

"Long" and "short" calendars will appear in alternate BULLETINS. The "short" calendar notes meetings in the few immediate weeks ahead—the "long" calendar for months ahead.

MALLEABLE FOUNDERS' SOCIETY—April 8–9, Market Development Conference, Pittsburgh, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS—April 12–15, Spring Aeronautical Meeting, New York, N. Y.

NATIONAL PETROLEUM ASSOCIATION—April 14–16, 51st Semi-Annual Meeting, Cleveland Hotel, Cleveland, Ohio

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS—April 14–16, Spring Meeting, Cincinnati, Ohio

AMERICAN ZINC INSTITUTE—April 20–21, Annual Meeting, St. Louis, Mo.

METAL POWDER ASSOCIATION—April 26–28, Annual Meeting, Drake Hotel, Chicago, Ill.

AMERICAN SOCIETY OF TOOL ENGINEERS' INDUSTRIAL EXPOSITION—April 26–30, Convention Center, Phila., Pa.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS—April 30–May 1, Institute of Metals Division, 8th Annual Regional Meeting, Hotel Bond, Hartford, Conn.

ELECTROCHEMICAL SOCIETY, INC.—May 2–6, Spring Meeting, La Salle Hotel, Chicago, Ill.

AMERICAN WELDING SOCIETY—May 4–7, Exposition and National Spring Technical Meeting, Buffalo, New York

FOREST PRODUCTS RESEARCH SOC.—Grand Rapids Mich., May 5–7.

AMERICAN FOUNDRYMEN'S SOCIETY—May 8–14, Convention and Exhibit, Public Auditorium, Cleveland, Ohio

AMERICAN PETROLEUM INSTITUTE, DIV. OF REFINING—May 10–14, Mid-Year Meeting, Rice Hotel, Houston, Tex.

PORCELAIN ENAMEL INSTITUTE—May 12–14, Midyear Div. Meeting, Chicago, Ill.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS—May 16–19, Hotel Kimball, Springfield, Mass.

BASIC MATERIALS EXPOSITION AND CONFERENCE—May 16–20, Chicago, Ill.

THE SOCIETY OF THE PLASTICS INDUSTRY, INC.—June 7–10, Sixth National Plastics Exposition, Cleveland, Ohio

AMERICAN INSTITUTE CHEMICAL ENGINEERS—June 20–25, Internatl. Meeting on Chem. Engineering Aspects of Nuclear Processes, Univ. of Michigan, Ann Arbor, Mich.

INSTITUTE OF THE AERONAUTICAL SCIENCES—June 21–24, Annual Summer Meeting, IAS Building, Los Angeles, Calif.

GSA Economies

As steward of Government property and records, General Services Administration pushed its economies to a record of more than $130 million in fiscal year 1953.

Savings from GSA stewardship were itemized in the GSA annual report which Edmund F. Mansure, Administrator of General Services, sent to Congress.

In summing up GSA activities, Mr. Mansure said, "The General Services Administration recorded in fiscal year 1953 the greatest progress in its 4 years' history—not only in direct and demonstrable savings, but also in constructive improvements pointed at greater efficiency and economy in the future."

Two Suggested Methods from Wax Polishes Committee

Suggested Method of Test for Concentrating Additives of Waxes

Methods for the determination of various properties of carnauba and other waxes have been of importance to the manufacturers of floor waxes for many years. ASTM Committee D-21 on Wax Polishes and Related Materials is now proposing the two methods presented here for publication as information only.

Comments are solicited and should be addressed to the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Scope:

1. This method describes a procedure for concentrating additives of carnauba wax and other high-melting-point natural and synthetic waxes. This serves to increase the significance of standard tests, such as saponification number, which cannot normally be used to advantage on samples which contain relatively small amounts of additive.

Method:

2. (*a*) The sample to be tested is subjected to a chloroform extraction. The carnauba wax is only sparingly soluble in the solvent, whereas most extenders are readily soluble. This results in a disproportionate dissolution of the additive with respect to the carnauba wax, thus serving to concentrate the extender in the chloroform extract.

(*b*) The mixture is subsequently filtered and the chloroform evaporated from the additive-rich extract.

(*c*) This extract is then treated in the same manner as an ordinary carnauba wax sample insofar as the usual characterizing properties of the wax are concerned. The extractions are carried out in triplicate.

(*d*) As a result of the extraction, certain components of the wax will appear in the extract in greater proportions than initially existed in the original wax sample. Thus the properties of a pure carnauba wax extract are shown to be different from those of a pure wax. Table I lists the variation in properties which might be expected in pure carnauba wax extracts.

Apparatus:

3. The apparatus shall consist of the following:

(*a*) *Erlenmeyer Flasks.*—Three 250-ml Pyrex glass narrow-mouth flasks, with full-length outer standard taper No. 24/40 ground joints.[1]

(*b*) *Condensers.*—Three Allihn or Leibig 300- to 400-mm condensers of Pyrex glass with standard taper No. 24/40 ground glass joints at bottom.[1]

(*c*) *Filtering Flasks.*—Three 250-ml heavy-wall filtering flasks.

(*d*) *Buchner Funnels.*—Three No. 1 Buchner funnels (56-mm inside diameter).

(*e*) *Rubber Stoppers.*—Three No. 6, one-hole rubber stoppers covered with aluminum foil. The hole shall be of sufficient size to accommodate the Buchner funnel (approximately 14 mm).

(*f*) *Filter Paper.*—Three sheets of 55-mm filter paper.

(*g*) *Beakers.*—Three 1000-ml beakers.

(*h*) *Stirrer*, of glass and motor driven to fit in the 250-ml Erlenmeyer flasks.

(*i*) *Sieve.*—A No. 8 (2380-micron) sieve[2] having a cover and pan bottom.

(*j*) *Mortar and Pestle*, of porcelain with a diameter of 80 to 115 mm.

(*k*) *Analytical Balance*, having a sensitivity to 1 mg and a capacity of 150 g.

(*l*) *Steam Bath*, with condenser tubing, assorted clamps, and ring stands for mounting apparatus in the bath.

(*m*) *Glass Beads*, 3 to 4 mm in diameter.

(*n*) *Graduated Cylinder* of 100-ml capacity, in 1-ml subdivisions.

(*o*) *Vacuum Oven*, with a minimum range of 110 C and a minimum vacuum of 20 mm of mercury, absolute.

(*p*) *Spatula.*—A smooth spatula of convenient size.

Procedure:

4. The following procedure shall be carried out for three samples:[3]

(*a*) Crush a representative sample of carnauba wax in the mortar and pestle until a sufficient quantity of sample passes through the No. 8 sieve.[2]

(*b*) Carefully weigh a 10-g sample of the sieved material (to 1 mg) into a 250-ml Erlenmeyer flask equipped with a standard taper 24/40 ground glass mouth. Add eight to twelve glass beads, followed by 75 ml of reagent grade chloroform dispensed from the 100-ml graduated cylinder. Seat, in an Erlenmeyer flask, a reflux condenser with a ground-glass joint corresponding to that of the flask. Mount the assembly on the steam bath and circulate cold water in the cooling jacket of the condenser. Adjust the steam rate to maintain a lively reflux and continue the action until the wax completely dissolves. Stop the steam supply and permit the condenser water to run until no further refluxing is observed. Wait at least 5 min then remove the reflux condenser and add an additional 25 ml of chloroform, at room temperature, to the contents of the flask. Pour it in such a manner that it completely washes down any material clinging to the sides.

(*c*) Place the Erlenmeyer flask and its contents in a 1000-ml beaker which has previously been filled to a depth of about 1 in. with ground ice. Then fill the beaker with ground ice to a point about 2 in. below the lip of the flask. Stir the contents with the motor-driven stirrer for a period of 1 hr. At the end of this period remove the flask from the ice bath and shake vigorously.

(*d*) Filter the contents of the flask through the filter paper in the Buchner funnel into a 250-ml filtering flask, maintaining the vacuum in the flask by means of an aspirator-type filter pump. The filtration should be carried out as

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[1] Manufactured by the Corning Glass Co., Corning, N. Y.

[2] Detailed requirements for these sieves are given in the Standard Specifications for Sieves for Testing Purposes (Wire-Cloth Sieves, Round-Hole and Square-Hole Screens or Sieves) (E 11), 1952 Book of ASTM Standards, Parts 2, 3, 4, 5, 6, and 7.

[3] "There is little danger of segregation of additives in sieving the ground carnauba wax. The common practice in adding additives to waxes is to melt the components together to secure a uniform blend. Such a procedure results in a homogeneous solid solution which renders segregation of the constituents, during sieving, very unlikely." (See Marcel, Kramer, and Morton, Footnote 4.)

quickly as possible in order to maintain the temperature at, or very near, 0 C. Add 25 ml of chloroform, previously cooled to 0 C, to the original Erlenmeyer flask in order to dislodge any material clinging to the flask. This additional volume shall also serve as the solvent wash for the precipitate in the Buchner funnel.

(*e*) After the washing has been completed, transfer the contents of the filtering flask to a 250-ml Erlenmeyer flask containing several glass beads, the flask and beads having previously been weighed to 1 mg. In order to remove successfully the last traces of extract from the filter flask, add 25 ml of warm chloroform to it, shake vigorously, and subsequently combine with the rest of the filtrate.

(*f*) Evaporate the chloroform on a steam bath under a hood or, alternatively, it may be recovered for further use by utilizing a condenser. Carry out the final drying of the wax extract in a vacuum oven maintained at 100 to 105 C, maximum vacuum of 20 mm of mercury, absolute.

(*g*) Set the flask aside to cool and then carefully weigh it.

(*h*) Withdraw a sample consisting of two or three drops of wax extract from each flask, in the manner described in Section 5(*c*) of the Suggested Method of Test for the Index of Refraction of Carnauba Wax and Other High-Melting-Point Natural and Synthetic Waxes, and ascertain the refractive index of each sample.

(*i*) Reweigh the flasks and set aside the extracts for saponification-number and acid-number tests.[4] The remaining extract may be used for other tests, or it may be used to verify the saponification number.

Report:

5. The report shall include the following:[5]

(*a*) Per cent by weight of original wax appearing in the extract (range of three results, to 0.1 per cent).

(*b*) Refractive index, n_D, at 100 C of extract (average of three results).

(*c*) Saponification number.[4]

(*d*) Acid number.[4]

Reproducibility:

6. Tests performed in triplicate on the extracts should agree within the following limits:

(*a*) *Per cent by Weight of Original Wax Appearing in the Extract.*—Individual values should differ by no more than 8 per cent from the mean.

(*b*) *Refractive Index.*—The refractive index should agree within a range of 0.0012 unit.

[4] These values should be included with this report. For test methods see Marsel, Kramer, and Morton, "A Critical Study of Certain Properties of Carnauba Wax," *Report No.* 1, the American Wax Importers and Refiners Assn., Inc., pp. 15–22.

[5] For significance of results, see Marsel, Treacy, and Godino, "Detecting Wax Additives," *Soap and Sanitary Chemicals*, November and December, 1952.

TABLE I.—VARIATION IN PROPERTIES OF PURE CARNAUBA WAX EXTRACTS[a,b]

Saponification number	84.0 to 93.7
Acid number	(*a*) Unbleached, 9.3 to 17.1 (*b*) Bleached, 28.6 to[c]
Iodine number	27.1 to 29.6
Refractive index at 100 C	1.4592 to 1.4962[d]
Material extracted, per cent by weight	5.3 to 13.0

[a] The properties listed in this table are from the following sources: (1) Marsel, Treacy, and Godino, "Detecting Wax Additives," *Soap and Sanitary Chemicals*, Vol. 27, No. 7, July, 1951, p. 122. (2) Marsel, Treacy, Brenner, and DeLong, "The Detection of Additives in Vegetable Waxes," *Soap and Sanitary Chemicals*, Vol. 28, No. 11, p. 127, November, 1952; Vol. 28, No. 12, p. 181, December, 1952. The index of refraction is for 100 C.

[b] All the indexes of refraction, as well as other constants given in this table, were determined in the laboratories of the Department of Chemical Engineering, New York University, New York.

[c] Experimental data for the upper limit is as yet undetermined.

[d] Note that the range of refractive index of 1.4592 to 1.4692 as given in this table is for the *extract portion* of *unadulterated carnauba* wax. The indices mentioned in the "Suggested Method of Test for the Index of Refraction of Carnauba Wax" of 1.4456 to 1.4478 at 100 C are for pure carnauba wax alone. The reason for the differences is that even the extraction of pure carnauba with a solvent results in a preferential solution of certain components of the wax, such as resins, acids, etc.

Suggested Method of Test for the Index of Refraction of Carnauba Wax and Other High-Melting-Point Natural and Synthetic Waxes

Scope:

1. This method of test is used for the determination of the index of refraction of carnauba wax and other high-melting-point natural and synthetic waxes. It may be used to detect the presence of certain additives and contaminants. It is not suitable for determining the presence of all adulterants, or for analysis of waxes recovered from solvent or water-emulsion systems.

Method:

2. The refractive index of the wax sample at 100 C is used as a criterion of adulteration.

Apparatus:

3. The apparatus shall consist of the following:

(*a*) *Refractometer.*—The refractometer shall consist of an Abbé refractometer equipped with compensating Amici prisms.

NOTE.—May be either Bausch & Lomb or Spencer apparatus.

Caution.—Any Abbé refractometer of Bausch & Lomb manufacture can be used at temperatures up to 100 C without damage to the instrument, if the following precautions are taken.

The instrument should be in good operational condition, especially in reference to a tight seal around the entrance and exit temperature-control nipples, and the cement around the prisms should be in good condition. To prevent damage to the prisms, it is very essential that the temperature be brought up to 100 C as slowly as possible. When the instrument is cooled from 100 C again it must be cooled as slowly as possible. This is necessary to prevent damage from contraction and expansion of the prism cement and prism housing, which expand and contract at different rates.

Steam has been employed as the temperature control medium, as follows: Use hot water to bring the temperature of the prism housing up as close as possible to 100 C before introducing steam into the system.

(*b*) *Thermometer.*—Any thermometer reading to at least 0.2 C in the range 95 to 105 C is suitable. In addition, a No. 00 one-hole rubber stopper is required for mounting the thermometer in the thermometer well.

(*c*) *Low-Pressure (1 atm) Steam Source.*—A source of low-pressure steam and a needle valve for throttling the steam to atmospheric pressure.

(*d*) *Rubber Tubing Connections.*—A sufficient length of $\frac{1}{4}$ by $\frac{1}{16}$ in. rubber tubing to provide the steam supply to the heating coils of the refractometer, and for disposing of the condensate.

(*e*) *Dropping Pipet*, with rubber bulb.

(*f*) *Steam Bath.*

(*g*) *Cleaning Accessories.*—Absorbent cotton and chloroform.

Procedure:

4. (*a*) Melt an average sample of the carnauba wax to be tested in a suitable container suspended above the steam bath. Avoid direct heat such as a flame or hot plate, and do not hold the wax sample in the molten state any longer than necessary.

(*b*) Drain any condensate in the low-pressure steam line prior to connection with the inlet heating coil of the refractometer. When "live steam" emerges from the needle valve, close the valve and make the appropriate rubber tubing connection, then slowly and cautiously open the needle valve, until the thermometer indicates a temperature of 100.0 C. This procedure should not take less than 2 min. The refractometer is ready to use when the temperature remains constant to within ±0.1 C for at least 5 min.

(*c*) Place the instrument so that diffused daylight or any form of artificial light can be used for illumination. Open the double prism by means of the screw head and transfer the wax sample to the prism by means of a warm dropping pipet (to prevent solidification). One or two drops will suffice. Close the prism firmly by tightening the screw head. Let stand for at least 3 min to come to uniform temperature. Move the alidade on the side scale backward or forward until the field of vision is divided into light and dark portions. Rotate the screw head of the compensator until a sharp colorless line is obtained. Lock the alidade in position and make any further adjustments with the fine screw situated on the alidade. Adjust the line between the fields so that it falls in the point of intersection of the two cross hairs. Read the refractive index directly on the scale.

(*d*) Record the refractive index when the reading is constant to 0.0002 units for a period of not less than 3 min.

(*e*) The refractometer prism may be cleaned by wiping the wax off repeatedly with absorbent cotton while it is still molten. The last traces may be removed by absorbent cotton soaked in warm chloroform. Avoid prolonged breathing of solvent vapors.

Report:

5. Report the refractive index as n_D at 100 C.

NOTE.—This value is uncorrected for the change in refractive index of the glass prism with temperature.

Reproducibility of Results:

6. Results of duplicate tests should not differ from one another by more than 0.0003 unit.

APPENDIX

Most commercial carnauba wax has a refractive index of between 1.4456 and 1.4478 at 100 C. Samples occurring outside of this range may have been adulterated. Observed refractive indices greater than 1.4478, at 100 C usually indicate presence of a resinous additive. (Durez, Piccolyte, Batu, Damar, etc.) Correspondingly a low refractive index precludes the presence of a resin and implies the presence of a wax or waxlike additive (for example, paraffin wax, microcrystalline wax, hydrofol glycerides, spermafol, spermaceti, etc.). Table I lists the refractive indices of some of the more common carnauba wax extenders.

Carnauba wax and other natural waxes are mixtures of higher alcohols, esters, acids, etc., and may vary considerably in chemical composition and physical properties as a result of varying growing conditions, collection procedures, and refining practices. Consequently the determination of the purity of a given sample may require extensive and time-consuming analytical procedures. This method is rapid and is often useful in detecting gross adulteration or extension of the wax. Refractive indices which are within the range given for carnauba wax do not necessarily imply freedom from additives. Certain extenders have refractive indices sufficiently close to that of pure carnauba wax so that the addition of these substances in modest quantities does not appreciably alter the refractive index of the original wax.

TABLE I.—REFRACTIVE INDICES OF CARNAUBA WAX EXTENDERS.[a, b]

Type of Additive	Additive	Refractive Index at 100 C of pure Additive[c]
Natural waxes.	Paraffin	1.4212 to 1.4260
	Candelilla	1.4514 to 1.4523
	Ouricuri	1.4478 to[d]
	Spermaceti	1.4252 to 1.4257
	Beeswax	1.4329 to[d]
	Microcrystalline	1.4237 to 1.440
Synthetic waxes.	Spermafol No. 52	1.4272 to[d]
	Hydrofol glycerides —Code 200	1.4425 to
	I. G. Wax K.P.S.	1.4420 to
Natural resin..	Batu East India	1.512 to[d]
	No. 1047 Fine Melt Pale Congo	1.520 to
	Damar Singapore No. 1	1.511 to
Synthetic resin..	Shanco No. 300	1.532 to[d]
	Lewisol No. 28	1.520 to
	Durez No. 219	1.528 to
	Piccolyte S-115	1.508 to

[a] The properties listed in this table are from the following sources: (1) Marsel, Treacy, and Godino, "Detecting Wax Additives," *Soap and Sanitary Chemicals*, Vol. 27, No. 7, July, 1951, p. 122. (2) Marsel, Treacy, Brenner, and DeLong, "The Detection of Additives in Vegetable Waxes," *Soap and Sanitary Chemicals*, November, 1952, Vol. 28, No. 11, p. 127, December, 1952, Vol. 28, No. 12, p. 181. The index of Refraction is for 100 C.

[b] As a guide to analysts, the following are refractive indices (see Footnote *c*) of some of the common wax extenders. These values are from the sources given in Footnote *a*.

[c] All the indexes of refraction given in these tables were determined in the laboratories at the Department of Chemical Engineering, New York University, New York.

[d] Experimental data for the upper limit is as yet undetermined.

High-Temperature Organic and Semiorganic Materials

BASIC problems arising in the investigation of high-temperature liquids and polymers were discussed in a symposium held recently at the National Bureau of Standards. A total of 28 technical papers was presented before approximately 250 scientists representing industrial, government, and university laboratories.

In recent years there has been increasing scientific interest in substances that are stable at high temperatures and that also have a wide variety of other useful properties. One class of high-temperature materials that is becoming rather well defined is that of the organic or semiorganic liquids and polymers. The physical properties of these substances are the result of inter- and intramolecular forces which are associated with strong covalent bonds in a chain-like molecule having weak forces between chains. In most cases the chain may also have many geometric configurations because of the relatively free rotation of parts of the molecule about axes provided by the chain linkages. In these characteristics and in their stability at temperatures between 250 and 500 C, the high-temperature liquids and polymers differ markedly from most of the better known materials such as rubber and ceramics.

Research reported at the meeting would seem to indicate that partially or completely conjugated chains of alternating single and double or triple bonds are most likely to fulfill requirements for liquids or polymers stable at temperature from about 400 to 500 C. Elements forming the chain may be carbon, silicon, nitrogen, or phosphorus, and perhaps a few others. Of the aliphatic or single-bond structures, only the fluorocarbons appear to be in this higher temperature class. Although these conclusions represent the current consensus, as brought out in the discussions, there was sufficient divergence of viewpoint to emphasize the need for basic research of an even broader scope in the field of high-temperature materials.

Random Samples . . .

FROM THE CURRENT MATERIALS NEWS

From the broad stream of current materials information flowing from "in-box" to "out-box" in a busy editorial office, random samples (mostly random) have been plucked. Thinking them worth re-showing to ASTM'ers who may have missed the original articles, we have included them here. Of course, we had to trim the samples to fit. There will be those who are not satisfied with samples, especially ones which are not really random. But these ASTM'ers can contact the institution, magazine, governmental agency, etc., who placed the original information in the stream. We have quoted literally, sometimes without quotation marks where the point of omission is obvious, and we have given credit to the source. These credit lines are also for the use of ASTM'ers whose entire curiosity has been aroused.

Beryllium Copper Alloys in Subzero Cold

A TWO-YEAR study completed at the University of Pennsylvania, discloses that mechanical properties of beryllium copper are able to withstand extreme temperature conditions as low as −300 F. The study shows that the alloy in some respects displays improved performance in the subzero range.

These findings are expected to have important bearing on the types of design materials used in equipment operating in intense cold. Such equipment would include aircraft parts and instruments, radar, and devices for handling refrigerants and liquefied gases.

Conducted under the direction of Dr. Robert M. Brick, head of the University's Department of Metallurgical Engineering, the study was sponsored by The Beryllium Corp. Tests were confined to commercial types of wrought and cast beryllium copper alloys, marking the first time low-temperature studies have been made upon commercial grades of the alloy.

Starting at normal room temperature, beryllium copper was tested for performance at successive levels down to −300 F, a record low for testing the alloy.

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A Growing Problem

EVEN waste disposal is a "hot" problem for the Atomic Energy Commission. Every industrial plant must be careful that its noxious gases, liquids, and solids do not endanger public health, but the unique and persistent character of radioactive wastes presents a disposal problem involving future generations.

Controls for the disposal of the relatively low-level activity from the average research and medical radioisotope user are working well. The problem looms larger for industry in the event that nuclear reactors come into use in the power and chemical industries, because these atomic furnaces or "piles" would accumulate most of the peacetime radioactive wastes. Judging from the total amount of uranium available in the world, the physical mass of the waste products would be small in terms of normal waste disposal volumes. The concentrated wastes, however, are toxic for long periods. Concentrating the residues to a small volume is also difficult. For example, the released radioactive energy heats the waste and may cause undesirable melting, volatilization, etc. Furthermore, while radiation levels from long-lived wastes may be dangerous, they may turn out to be too low for such uses as sterilizing foods and biologicals or starting chemical reactions. The AEC is actively studying possibilities for their use and for convenient disposal, but no conclusions are yet generally accepted. The AEC is responsible for insuring national safety on this point and maintains a continuous research program in this field. Also it denies to unqualified users the right of possessing fissionable or radioactive materials.

Concentrated liquid wastes from some AEC reactors are now stored in underground steel tanks. Corrosion will make eventual replacement of the tanks necessary, and sometimes cooling coils are needed to remove the heat generated by radioactive decay. Industrial use of nuclear reactors will produce much more waste and require more permanent disposal methods, for dangerous levels of activity will persist in some cases for generations. In four years the activity drops to a level one-tenth that at six months, but dealing in large quantities of radioactivity even this level is hazardous and may continue for decades.

Armchair theoreticians would like to shoot hot wastes into outer space, where they can contaminate nothing but a space ship. The general earthbound approach is to immobilize the radioactivity in some durable solid form that can be hidden away from future generations. For example, concentrated liquid wastes might be used instead of water in making concrete blocks to be buried in an arid spot where they would not introduce excessive radioactivity into ground water, or the blocks might be dumped into the ocean where they would bury themselves in the murk on the bottom. Fusion in glass or in special clays, followed by burial, is also being considered. Depleted oil wells from 1000 to 10,000 ft deep might hold raw liquid radioactive wastes. The wells would be gas-tight, and migration of radioactive products through rock strata would be slow.

To avoid transportation problems, it would be better to bury the blocks near the producing site; in this event, care would have to be taken to insure that hazardous amounts of radioactivity were not added to the local water supply.

Short-lived isotopes which lose half their radioactivity in a few hours or days may be flushed into a city sewer system under prescribed conditions. Many current users of such materials, including hospitals, prefer simply to set the waste products aside to die a natural death, still safe in their protecting containers.

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Titanium Melting Process

TITANIUM-alloy ingots weighing up to 100 lb can now be produced by a double melting process worked out at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The process can easily be applied to commercial-scale production of these alloys, which are rapidly becoming important because their light weight and high strength make them valuable in jet aircraft construction.

The process starts with titanium and alloying metals, such as aluminum and silicon, fed into a nonconsumable-electrode are melting furnace. This produces an ingot that contains the desired combination of metals but is not homogeneous enough to be of much use. Alloying elements are likely to be segregated in parts of the ingot.

The next step is to forge this ingot into a rod, which is then remelted at a consumable electrode in another arc furnace. Fed in vertically through the top of this furnace, it melts in an electric arc playing between it and the pool of molten metal just below it. Because all of the metal must pass through the intense heat of the arc and because a larger and hotter molten pool is maintained than is possible with the other furnace, the alloying metals get dispersed throughout the mixture. A homogeneous alloy results.

Work at Armour on the process started in 1948 and has progressed steadily since then. One of its results is the present consumable-electrode furnace of relatively large capacity.

The crucible in which alloy is melted in the consumable-electrode furnace consists of a copper tube with $\frac{1}{4}$-in. walls enclosed in a brass water jacket. An argon atmosphere is maintained in the crucible to prevent oxidizing of the titanium alloy.

Melting is started by striking an arc tween the lower end of the electrode and a titanium-alloy "stool" secured to the crucible bottom. The electrode is fed in continuously to maintain a steady arc. When an ingot has been built up on the stool to a height of 6 to 8 in., a retracting mechanism is turned on and adjusted to the rate of casting. This mechanism withdraws the ingot continuously through the bottom of the crucible.

Armour research men say that larger ingots than the 6-in.-diameter ones they are now producing could be achieved by increasing the power used. The only limits on size, they say, are the physical limits on the distance the ingot can be withdrawn and the diameter of the molten pool that can be maintained.

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Energy Losses in Motors

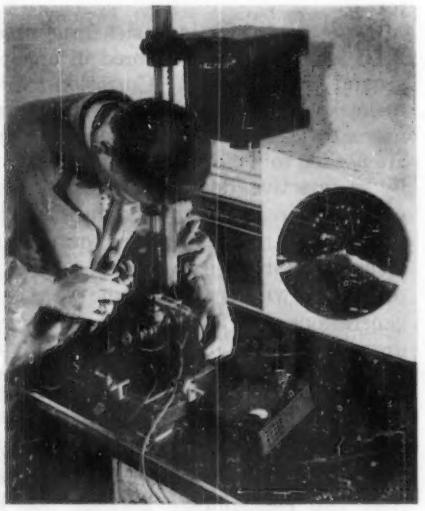
FURTHERING research into the causes of energy losses in electric motor and transformer cores, scientists at U. S. Steel's Research and Development Laboratory in Pittsburgh, Pa., are conducting an extensive study of magnetic domains in electrical steels. The earliest experimental work in the U. S. on magnetic domains, or tiny oriented magnetic areas within the crystals of steel, started back in 1932.

Power losses in transformers (attributable to the characteristics of the steel used in making the cores) are known as "core losses." We all remember there is a measurable loss through hysteresis, or lag behind the field when steel is magnetized by a magnetic field made to vary through a cycle of values—and there is another loss created by eddy currents, or induced electric currents which lower efficiency and increase temperature of rotating metallic objects in a magnetic field. These two losses do not add up to the total core loss, so a third, unknown cause is being sought. This loss is called "anomalous loss."

Modern electric motors and transformers have been brought to a high degree of efficiency through the use of silicon steels. These steels, first patented by Sir Robert Hadfield about the year 1900, permit the necessary alternations of the magnetic field without undue energy losses. In addition, they possess increased electrical resistance which diminishes that part of the loss due to eddy currents. They also exhibit relatively little aging effect.

In most sheet products, directionality of magnetic properties is undesirable, but in certain applications in the electrical industry it has a definite advantage. Cores can be wound or transformer laminations can be cut to take advantage of such directionality. Consequently, electrical sheet manufacturers strive to develop this characteristic to a high degree.

This directionality of magnetic properties is achieved through crystal orientation which in the case of silicon steel takes the form of a cube with the iron and silicon atoms located at the corners. By closely controlled techniques of rolling and heat treating, every effort is made to cause at least most of these cubes to align themselves in the same direction. The best magnetic properties are in the rolling direction.



U. S. Steel Corp.

The microscope is an important tool in studies of the formations of magnetic domains within the crystal structure of electrical steel. The circular inlet at the right is a typical example of magnetic domain patterns in silicon steel.

Certain magnetic domain orientations may further improve the directional properties of grain-oriented steels. The present research into magnetic domains is to determine their characteristics and possibly to discover ways to control their orientation.

In the laboratory, a test sample of steel about the size of a dime is punched from a sheet of steel being studied. This disk is first mechanically polished and then electropolished to insure an ultra-smooth strain-free surface.

A drop of a colloidal suspension of magnetite (Fe_3O_4) is applied to the surface and then faced with a glass cover plate. Under a microscope the prepared disk is placed between the poles of an electromagnet with the rolling direction parallel to the direction of the applied magnetic field. The minute magnetic solid particles in the colloidal suspension are attracted to the edges of the magnetic areas within the crystals of the steel. They form a clear outline of each domain and make it possible for the scientist to see the magnetic domain patterns within the steel crystals.

As current is supplied to the magnet, the domains form patterns determined by the crystal orientation and the strength of the applied magnetic field. In effect, the research technologist can actually see and study the process of magnetization.

The stage of the microscope is also provided with a screw clamp so that the test disk can be put under measured stress. This makes it possible to study the effects of mechanical strain on magnetic domains.

"As in most pure research projects, the end benefits of any discoveries made are not clearly discernible. It is hoped, however, that out of the data being accumulated a new and more efficient electrical steel will be evolved," said George Pellissier, research associate who is supervising the magnetic domains studies.

Erratum

A CONFUSING printer's error has occurred in the Tentative Specification for Molybdenum-Steel Plates for Boilers and Other Pressure Vessels (A 204) on p. 174 of Part 1 of the 1953 Supplement to Book of ASTM Standards.

In Table I covering chemical requirements there are two listings for silicon and molybdenum content. Only the second listings in the table which specify requirements for ladle analysis and check analysis should be retained. In inserting the new requirements the printer neglected to omit the old.

A Study of Some Operations Involved in Cement Analysis

By Leonard Bean and Ethel J. Hackney[1]

In 1952 the Bureau of Standards sampled 13.5 million barrels of cement providing opportunity for a study of chemical and physical analysis methods and answers to some persistent questions about them.

THE Concreting Materials Section of the National Bureau of Standards tested 26,000 samples, representing 13.5 million barrels of cement, during the fiscal year 1952. This cement was used by Government agencies for construction projects. About one million barrels of this cement failed to meet the specification requirements. Usually a chemical analysis is required for each 2000 barrels.

The goal in writing specification methods for physical and chemical tests has been to provide methods which give reproducible results, are not too time consuming, and can be performed with the equipment usually found in an average well-equipped laboratory. The Analytical Laboratory of the Concreting Materials Section, National Bureau of Standards, together with several others, has cooperated in efforts to improve the methods used for the chemical analysis of cement, both in the Federal Specification[2] and ASTM Methods.[3] Periodic revisions in the methods have resulted. Some of the recent changes have followed from the studies presented here.

Inquiries are frequently made concerning the factors which in cement analysis contribute to the spread in results obtained between different laboratories as well as between different operators in the same laboratory. The fact that all cement laboratories do not have the same types of equipment and facilities complicates the problem. The purpose of these studies was to answer some of the questions that arise by finding the effects of various methods of precipitation, washing, and ignition upon the results obtained. No attempt was made to study each operation encountered in the analysis of cement; only those operations were studied about which questions had arisen, either from within our laboratory or from the outside. For example, no study was made of the precipitation and ignition of $MgNH_4PO_4$. In many laboratories, including this one, this method (par. 4.3.6.2.2[2] and Sec. 15) is used in cement analysis only when there is a dispute or failure to meet the specification requirement for magnesium. In the past 12 years no such occasion has arisen in this laboratory. On the other hand we are constantly queried about volatilization of platinum during the ignition of silica and the ammonium hydroxide group. Another point frequently raised concerns the relative merits of platinum, porcelain, or pyrex glass dishes for the double dehydration of silica. These and other points frequently questioned in cement analysis were studied, and the results are shown in this report. The methods of analysis used in this work, except where otherwise described, are the latest Federal Specification methods.[2]

Ignition of Silica and Ammonium Hydroxide Group

The study of the ignition of silica and R_2O_3 includes studies of the time required to obtain constant weight on precipitates obtained from ½-g samples of portland cement, the effect of prolonged heating of precipitates, volatilization of platinum at the temperature required for the ignition, possible reduction of Fe_2O_3 to Fe_3O_4, and the effect of various methods of burning off filter paper.[4]

The silica and R_2O_3 obtained in the routine chemical analysis of six samples of type II cement[5] were used to study the time required for ignition to constant weight. The filter papers, containing the precipitates were placed in weighed, pure platinum crucibles[6] and then very carefully burned off over Chaddock[7] burners without flaming. Then the crucibles were placed in a fused silica channel which was in turn placed in a muffle furnace. The furnace was of the "Globar" type and its temperature was automatically controlled by an indicating controller used with a platinum and platinum - 10 per cent rhodium thermocouple.

Ignition Time for Silica:

In Table I are given the weights of the empty crucibles and the weights of the crucibles plus crude silica after igniting at the temperatures and for the periods of time indicated. An ignition temperature between 1100 and 1200 C is required in the Federal Specification[2] both for the umpire (par. 4.3.3.2.1) and the alternate (par. 4.3.3.1.1) methods. ASTM Standards[3] require 1100 to 1200 C in the standard method (Section 8(*c*)) and 1050 to 1100 C in the alternate method (Section 33). After each heating period given in Table I, the crucibles were placed in a desiccator for 1 hr and then weighed on a rapid-weighing, magnetically damped analytical balance which required no use of fractional weights.

The requirements for analytical bal-

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] Formerly, Chemist, Concreting Materials Section, National Bureau of Standards, Washington, D. C. Photograph not available.

[2] Federal Specification—Cements, Hydraulic, Methods for Sampling, Inspection and Testing (SS-C-158c), April 22, 1952, Supt. of Documents, U. S. Government Printing Office, Washington, D. C.

[3] Standard Methods of Chemical Analysis of Portland Cement (C 114 - 47), 1952 Book of ASTM Standards, Part 3, p. 62.

[4] The commonly accepted general formula R_2O_3 is used to denote the precipitate of the ammonium hydroxide group.

[5] Federal Specification—Cement, Portland (SS-C-192a), April 22, 1952, Supt. of Documents, U. S. Government Printing Office, Washington, D. C.

[6] The platinum crucibles used in this work were specially ordered to be "made of pure platinum, no alloy." In this laboratory such crucibles, although more easily deformed, have been found to maintain more constant weight during ignitions than those of platinum alloyed with iridium, rhodium, or other metals.

[7] An illustration and description of a Chaddock burner is given in "Hackh's Chemical Dictionary," Third Edition, The Blakiston Co., Philadelphia, p. 184 (1946). This burner is similar in its action and temperature attained to a Bunsen burner, but is made of pottery and supports a triangle without requiring a ring stand or ring. The body of the burner acts as a chimney to protect the flame from blowing out in drafts.

LEONARD BEAN is in Charge of Analysis of Cement at the Washington laboratory of the Concreting Materials Section, National Bureau of Standards, where he has been employed since 1941. He is co-author of a number of papers on cement analysis.

ances in the specifications mentioned include a statement that they must be accurate to within 0.2 mg. Therefore in many cement laboratories a precipitate is considered to be at constant weight if the weights after successive heating periods differ by no more than 0.2 mg. A study of the data of Table I shows that the latter is not a safe assumption. In all six cases the second heating period of 10 min gave weights of crude silica differing by no more than 0.2 mg from the weight obtained after the first heating for 20 min at 1150 C. Further heating at 1200 C for 50 min reduced 5 out of 6 weights by more than 0.2 mg, indicating that the previous two weights had not been true constant weights. Evidently the check heating time of 10 min had not been sufficient: perhaps at 1150 C it was only long enough to drive off an additional 0.1 to 0.2 mg.

In view of the remaining possibilities that even longer heating at 1200 C might show that the top weights given in Table I still were not true constant weights, or that the platinum crucibles were losing an appreciable amount of weight at this temperature during the period of heating involved, a further test was carried out. The silica was separated from duplicates of two more samples of cement and the filter paper burned off as previously described with final ignition for 1 hr at 1200 C. Desiccation, weighing, reheating at 1200 C for 30 min, desiccation, and another weighing, indicated constant weight within 0.1 mg in all cases. A blank determination was carried through simultaneously. Following this, the crucibles were heated at 1200 C for an additional 16 hr after the precipitates had come to constant weight, desiccated, and weighed. The results obtained are summarized in Table II. It will be noted that the blank lost 0.1 mg more weight than any of the samples. This indicates that the silica lost no more weight after the first hour of ignition at 1200 C, the loss shown being platinum.

The five crucibles used for the work upon which Table II is based were cleaned, weighed, and then ignited again for 16 hr at 1200 C. Table III gives the losses in weight. The greatest loss in weight of platinum is 0.04 mg per hour. This is, of course, negligible as far as the ordinary heating periods of 1 or 1½ hr are concerned. The weight losses shown during 16 hr in Table II exceed those in Table III by a few tenths of a milligram. The differences shown are all of the magnitude of 0.2 mg, the uncertainty of the balance, but they are all in the same direction. This might seem to indicate a further loss of 0.1 to 0.2 mg by the silica during the 16 hr, if it were not for the behavior of the blank. Table II shows that the blank (practically an empty crucible except for filter paper ash) lost more weight than any of the other crucibles and 0.3 mg more than it did in Table III when absolutely empty. This behavior, although probably not significant, remains unexplained.

The combined data of Tables I, II, and III show that an ignition period of 1 hr at 1200 C was sufficient to obtain constant weight for the amounts of silica obtained from 0.5 g of cement and that platinum loss during the period was negligible. An examination of routine cement analysis data in this laboratory showed that 1 hr of heating at 1200 C failed to give constant weight for silica only nine times out of 882. This was established by subsequent heating periods of 30 min each.

Ignition Time for R_2O_3:

The technique used to determine the heating time required for R_2O_3 was essentially the same as that described for silica. Both the Federal Specification and ASTM methods specify ignition at 1050 to 1100 C. Table IV gives the weights of the empty crucibles and the weights of crucibles plus R_2O_3 after heating 15 min at 1050 C, 10 min more at 1050 C, 50 min more at 1100 C, and finally 25 min more at 1100 C. If the usual criterion of weight agreement within 0.2 mg is used, inspection of Table IV shows that 15 min at 1050 C seemed to give constant weight, as another 10-min heating at

TABLE I.—TIME REQUIRED TO ATTAIN CONSTANT WEIGHT FOR IGNITION OF SILICA FROM 0.5 G OF CEMENT.
Six different samples. Read from bottom up.

	Time and Temperature	Weights, g					
		Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6
Crucible + SiO_2	20 min more at 1200 C	30.9174	30.8461	32.5272	30.9605	30.8977	31.0167
Crucible + SiO_2	50 min more at 1200 C	30.9174	30.8461	32.5273	30.9605	30.8978	31.0168
Crucible + SiO_2	10 min more at 1150 C	30.9178	30.8466	32.5278	30.9609	30.8980	31.0172
Crucible + SiO_2	20 min at 1150 C	30.9178	30.8464	32.5278	30.9608	30.8979	31.0170
Crucible		30.8077	30.7356	32.4140	30.8471	30.7843	30.9043

TABLE II.—EFFECT OF HEATING SILICA 16 HR AT 1200 C IN PURE PLATINUM CRUCIBLES AFTER PREVIOUSLY HEATING FOR 1½ HRS.
Duplicates of two samples, and a blank. Read from bottom up.

	Time and Temperature	Weights, g				
		Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	No. 5 Blank
Crucible plus SiO_2	16 hr more 1200 C	30.9299	30.8565	30.9528	30.8901	30.9019
Crucible plus SiO_2	30 min more 1200 C	30.9303	30.8573	30.9535	30.8908	30.9028
Crucible plus SiO_2	1 hr 1200 C	30.9303	30.8574	30.9535	30.8909	30.9027
Empty crucible		30.8066	30.7336	30.8455	30.7828	30.9028
Loss in 16 hr		0.0004	0.0008	0.0007	0.0007	0.0009
Loss per hr		0.000025	0.00005	0.00004	0.00004	0.000056

TABLE III.—PLATINUM VOLATILIZATION OF EMPTY CRUCIBLES HEATED 16 HR AT 1200 C.
Weight in grams.

	Crucible No. 1	Crucible No. 2	Crucible No. 3	Crucible No. 4	Crucible No. 5
Loss in 16 hr	0.0002	0.0006	0.0006	0.0006	0.0006
Loss per hr	0.00001	0.00004	0.00004	0.00004	0.00004

TABLE IV.—TIME REQUIRED TO IGNITE R_2O_3 FROM 0.5 G OF CEMENT TO CONSTANT WEIGHT.
Same samples as Table I. Read from bottom up.

	Time and Temperature	Weight, g					
		Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6
Crucible + R_2O_3	25 min more at 1100 C	30.8565	30.7831	32.4611	30.8938	30.8308	30.9512
Crucible + R_2O_3	50 min more at 1100 C	30.8565	30.7832	32.4612	30.8940	30.8309	30.9514
Crucible + R_2O_3	10 min more at 1050 C	30.8569	30.7835	32.4614	30.8941	30.8310	30.9516
Crucible + R_2O_3	15 min at 1050 C	30.8570	30.7835	32.4615	30.8943	30.8313	30.9518
Crucible		30.8077	30.7356	32.4140	30.8471	30.7843	30.9043

the same temperature appeared to confirm. Subsequent heating showed that this first assumption was not quite valid because two of the six samples lost more than 0.2 mg. Evidently the reheating period of 10 min was too short to prove anything.

The questions of possible platinum loss and whether real constant weight had yet been attained by the top weights given in Table IV were investigated. The same five crucibles whose platinum losses at 1200 C are shown in Table III were heated for 16 hr at 1100 C. The first two lost 0.2 mg, the third and fifth 0.1 mg, and the fourth weighed the same before and after the 16-hr heating period. For our purposes, then, platinum loss at 1100 C is negligible.

The R_2O_3 from three more routine cement analyses, plus duplicates of another cement, were heated in platinum crucibles 1 hr at 1100 C following slow combustion of the carbon. This was followed by 30 min further heating at the same temperature which showed weights constant with in 0.2 mg for each sample. Then the crucibles and their contents were further heated for 16 hr at 1100 C. Table V shows the results that establish the fact that further heating after 1.5 hr caused no appreciable loss. Column 6 shows the behavior of the blank which appeared to lose 0.2 mg in 16 hr. A similar loss may or may not have occurred in the crucibles containing the R_2O_3 from the samples, the uncertainty of the balance obscuring such small changes.

The data of Tables IV and V indicate that heating the R_2O_3 from a 0.5-g sample of cement for 1 hr at 1100 C can reasonably be expected to give constant weight. An examination of 1222 routine cement analyses in this laboratory showed that except for 37, one heating period of 1 hr at 1100 C produced constant weight within 0.2 mg. This was established by subsequent heating periods of 30 min each.

Possible Reduction of Fe_2O_3 to Fe_3O_4:

The question as to whether there is danger of reducing Fe_2O_3 to Fe_3O_4 by prolonged heating of R_2O_3 has sometimes been raised in connection with cement analysis. The data of Table V do not show any evidence that such reduction has taken place. Baxter and Hoover[8] in their atomic-weight work on iron found 1100 C to be an entirely safe temperature for the ignition of ferric oxide. They found that 5 g of Fe_2O_3 lost only 0.2 mg when heated in air as compared to heating in oxygen. An excellent discussion of this subject is given by T. B. Smith,[9] who indicates that there is no danger of any appreciable reduction that would affect analytical results when $Fe_2O_3+Al_2O_3$ is heated at 1100 C if precautions are taken not to heat over reducing gases. At temperatures over 1350 C oxygen is evolved from Fe_2O_3, according to Smith.

TABLE V.—EFFECT OF HEATING R_2O_3 FOR 16 HR AT 1100 C IN PLATINUM.
Read from bottom up.

	Time and Temperature	Weight, g					
		Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	No. 6 (Blank)
Crucible + R_2O_3...	16 hr more at 1100 C	30.3834	30.3976	30.3981	30.3788	30.3889	30.3568
Crucible + R_2O_3...	30 min more at 1100 C	30.3834	30.3975	30.3983	30.3791	30.3892	30.3570
Crucible + R_2O_3...	1 hr at 1100 C	30.3832	30.3973	30.3981	30.3791	30.3890	30.3570
Crucible.....		30.3363	30.3504	30.3512	30.3497	30.3595	30.3567

TABLE VI.—EFFECT OF FLAMING ON RESULTS OBTAINED FOR SiO_2 AND R_2O_3 FROM 0.5 G OF CEMENT.
Weights in grams from quintuplicate determinations on the same sample of cement.

	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5
SiO_2 (Pure)					
Filter paper burned off on Chaddock burners with flaming	0.1094	0.1096	0.1097	0.1093	0.1096
Filter paper burned in door of 900 C muffle with flaming	0.1097	0.1098	0.1099	0.1096	0.1097
Filter paper burned off without flaming in muffle	0.1098	0.1099	0.1097	0.1099	0.1096
R_2O_3					
Filter paper burned off on Chaddock burners with flaming....	0.0474	0.0472	0.0471	0.0463	0.0468
Filter paper burned in door of 900 C muffle with flaming	0.0475	0.0475	0.0475	0.0472	0.0471
Filter paper burned off without flaming in muffle	0.0472	0.0470	0.0470	0.0470	0.0469

Effect of Flaming on SiO_2 and R_2O_3 Results:

Texts on quantitative analysis generally recommend that the filter paper be burned off precipitates without allowing flaming to occur. This may require close supervision of the early stage of the ignition process. Some chemists have questioned the necessity for such care in cement analysis on the basis of their own experience. Therefore data were obtained on the subject.

A single sample of cement was tumbled for 30 min and ten 0.5-g samples of this were weighed out immediately. The silica was removed by the NH_4Cl method and R_2O_3 by the regular procedure. On five of the samples, the carbon from both the silica and R_2O_3 determinations was burned off on Chaddock burners with flaming. Care was taken to prevent spattering during the drying of the precipitates. On the other five samples, the carbon was burned off slowly, starting in a muffle furnace at room temperature with the door open slightly to allow free access of air. The temperature was then raised slowly to 500 C so that the paper did not flame. The temperature was maintained at 500 C overnight. The next morning the ignition of all the precipitates of the SiO_2 and R_2O_3 were completed at 1200 and 1100 C, respectively, until constant weight was attained. Five more samples of the same cement were weighed out and the SiO_2 and R_2O_3 separated as previously described. The filter paper in the platinum crucibles containing the precipitates was burned off in the open door of a muffle furnace maintained at 900 C. The crucibles were placed in such a position that flaming occurred. These were then heated to constant weight at 1200 and 1100 C. The silica and R_2O_3 weights obtained by the three techniques of burning off the paper are shown in Table VI. All the crude silica precipitates were treated with HF and H_2SO_4 in order to obtain the weight of pure SiO_2, the value shown.

The spread in values for each set where flaming was allowed to take place is greater than those without flaming, with the exception of the silica determinations which were allowed to flame in the open door of a 900 C muffle furnace. In all these experiments extreme care was taken in all cases to avoid spattering or popping during the drying of the precipitates and papers. From these data it appears advisable to take precautions to burn off the filter papers

[8] G. R. Baxter and C. R. Hoover, "A Revision of the Atomic Weight of Iron," *Journal*, Am. Chemical Soc., Vol. 34, p. 1657 (1912).

[9] T. B. Smith, "Analytical Processes," E. Arnold and Co., London, pp. 107–111 (1940).

without flaming, even though in one set it made no difference.

Hygroscopicity of R_2O_3

Some cement analysts have stated that they found no evidence to indicate that the ignited R_2O_3 precipitates showed any hygroscopic characteristics and therefore did not find it necessary to use covers on their platinum crucibles when determining R_2O_3. In Table VII are given the increases in weight of 16 routine R_2O_3 precipitates on standing. The relative humidity was not measured when the data of Table VII (*a*) were obtained, but it is thought to have been near 100 per cent during the earlier part of the work. The data of Table VII (*c*) seem to show a rough correlation between time of heating at the lower temperature (1050 C) and hygroscopic tendencies: in general, those heated for longer periods gained less weight on standing. Table VII indicates that ignited R_2O_3 from cement may be somewhat hygroscopic, that heating at 1100 C reduces this tendency, and that for the ordinary periods of time usually required to make a weighing no appreciable error is introduced by such hygroscopicity if the R_2O_3 has been ignited for 1.5 hr. Shorter periods of heating or use of the lower temperature of 1050 C would therefore appear to increase the necessity for well-fitting covers on the crucibles during weighing.

TABLE VII.—WEIGHT GAIN BY R_2O_3 FROM 0.5 G OF CEMENT WHILE STANDING UNCOVERED, IN MILLIGRAMS.

(*a*) No record of relative humidity. These precipitates had been previously heated for 1½ hr at 1100 C.

Total Gain After	Cement No. 1	Cement No. 2	Cement No. 3	Cement No. 4
1 hr.....	0.8	0.6	0.7	0.8
2 days.....	0.8	0.7	0.7	0.9
3 days.....	0.8	0.8	0.8	1.0
4 days.....	0.9	0.8	1.0	1.0

(*b*) Relative humidity about 52 per cent. Nos. 1, 2, 3, and 4 had been previously heated at 1100 C for 1 hr, 30 min, 1 hr 50 min, 2 hr 10 min, and 2 hr 30 min, respectively. After burning off filter paper at not to exceed 600 C.*

1 min....	0.0	0.0	0.0	0.0
2 min....	0.0	0.0	0.0	0.0
3 min....	0.0	0.0	0.1	0.1
5 min....	0.1	0.1	0.1	0.1
10 min....	0.1	0.1	0.1	0.1
1 hr.....	0.2	0.2	0.3	0.2
2 hr.....	0.2	0.4	0.3	0.3
3 hr.....	0.2	...	0.3	...
1 day....	0.2	0.4	0.3	0.2
2 day....	0.5	0.3	0.5	0.2

* These data were obtained by Nancy J. Tucker of this laboratory.

(*c*) Relative humidity about 35 per cent. Nos. 1, 2, 3, and 4 had been previously heated at 1050 C for 1½, 2½, 3½, and 4 hr, respectively, after burning off filter paper at not to exceed 600 C.[a]

1 min....	0.1	0.0	0.0	0.0
2 min....	0.1	0.1	0.0	0.0
3 min....	0.1	0.0	0.2	0.0
5 min....	0.2	0.0	0.2	0.0
10 min....	0.4	0.0	0.2	0.0
1 hr.....	0.5	0.3	0.4	0.0
2 hr.....	0.6	0.3	...	0.2
3 hr.....	0.7	0.4	...	...
1 day....	0.6	0.5	0.4	0.1
2 day....	0.7	...	0.5	...

(*d*) Relative humidity about 42 per cent. Nos. 1, 2, 3, and 4 had all been heated for 1 hr at 1050 C after burning off filter paper at not to exceed 60 0C. After the data shown had been obtained, the crucibles and their contents were reheated at 1050 C for 30 min. No weight differed by more than 0.1 mg from the weight obtained after the first hour[a] of heating.

1 min.....	0.0	0.0	0.0	0.1
2 min.....	0.1	0.1	0.2	0.1
3 min.....	0.1	0.2	0.2	0.2
4 min.....	0.1	0.2	0.3	0.3
5 min.....	0.1	0.2	0.3	0.3

Ignition of HF Residue

Under both of the Federal methods for the determination of silica in cement, the ignited, impure silica is treated with HF and H_2SO_4 and the residue ignited for "a minute or two" to obtain the weight of HF residue. The ASTM standard method requires the same treatment, although the alternate (NH_4Cl) method does not make the volatilization of the silica mandatory. Some question has been raised about the adequacy of one or two minutes heating at 1050 to 1100 C to insure constant weight of the small HF residue (generally less than 1 mg). Three methods of heating the crucibles containing this residue have been regularly used in this laboratory: (1) The crucibles are heated over Meker-type burners which we have found maintain the contents at about 1100 C. By comparison of R_2O_3 ignitions over these burners with results obtained in a muffle furnace at 1100 C, we feel fairly safe in assuming that the burners do give comparable results under the conditions used. (2) The crucibles are placed in holes in a fused silica tray which is then placed in a muffle furnace at 1100 C. (3) The crucibles are placed in a fused silica channel which is then placed in a muffle furnace at 1100 C.

The time of heating required to insure constant weight of HF residues was determined using the three techniques just described. A summary of the results showed the following: Constant weight was attained most rapidly over the Meker-type burners, 1 min being sufficient for most samples, although 3 min were required by a few. Nearly all those that were heated in a muffle furnace on the fused silica trays attained constant weight in 2 min, but a few required 4 min. When fused-silica channels were used to support the crucibles in the muffle furnace, 3 min at 1100 C was insufficient to insure constant weight. The crucibles were in contact with such a large mass of cool tray as well as being shielded by it, that 5-min heating was required before all the weights were constant. It appears, therefore that it would be safer to require 5-min heating at 1050 to 1100 C for HF residues in order to assure constant weight.

Effect of Different Types of Evaporating Dishes on Silica Determination

In this laboratory, at the present time, all double dehydrations of silica are done in 300-ml platinum evaporating dishes. Some years ago we used 300-ml porcelain casseroles for the purpose. One type of casserole is glazed inside and outside except for the rim; another type is glazed inside, outside, and on the rim. We have never used chemical pyrex beakers for this purpose, although several chemists from commercial laboratories have informed us that they use the beakers and see no objection to their use. Other analysts indicate that they think fairly new beakers are satisfactory, but beakers that have become scratched or etched from use should not be used for this purpose. The authors have been asked just how much difference it makes whether silica is dehydrated in platinum or in a pyrex beaker.

In order to obtain some data on the subject in connection with cement analysis, the following experiments were performed.

Repeated determinations of silica were made on a carefully tumbled sample of type II cement by the umpire method (par. 4.3.3.2.1).[2] The evaporations were performed on a steam bath, some in 300-ml platinum evaporating dishes, some in 300-ml porcelain casseroles with unglazed rims, some in 300-ml porcelain casseroles with glazed rims, some in new 250-ml chemical pyrex beakers, and some in 250-ml chemical pyrex beakers that had been scratched from considerable use. Following the second evaporation the dishes were heated for 1 hr at 105 C. The results are shown in Table VIII. They indicate that a higher silica value of about one part in 225 was obtained when platinum evaporating dishes were used. There seemed to be little to choose between the other utensils. Because the same number of determinations were not made with each type of utensil, the ranges may not be too significant. The trend, however, is certainly in favor of the use of platinum, if available. The authors wish to make it clear that they do not recommend the use of glass beakers for this purpose. The shapes of the beakers are not conducive to ease in policing out all the silica. Contamination by the silica from the glass may

TABLE VIII.—EFFECT OF TYPE OF EVAPORATING DISH ON SILICA DETERMINATION BY DOUBLE-DEHYDRATION METHOD.

Per cent SiO_2 found in a sample of type II cement.

Platinum Dishes	Chemical Pyrex Beakers		Porcelain Casseroles	
	New	Scratched	Partly Glazed	Completely Glazed
22.64	22.48	22.50	22.50	22.48
22.60	22.48	22.58	22.48	22.50
22.62	22.52	22.46	22.42	22.48
22.58	22.56	22.50	22.54	22.50
22.58	22.50	22.54	22.50	
22.54	22.50	22.54		
22.62		22.52		
22.60		22.44		
22.58		22.56		
		22.54		
Average 22.60	22.51	22.52	22.49	22.49

also be a matter of concern. It is possible that these two errors may cancel each other.

Single Precipitation of Calcium Oxalate

The latest ASTM method (Sections 13 and 35(*a*))[3] and the next to the latest Federal Specification (par. F18b and F19a)[10] for the determination of calcium in cement are practically identical. According to these, in the umpire method the calcium is separated by a double precipitation as the oxalate and ignited to CaO. In the alternate method, a single precipitation is used, followed by titration of the oxalate with standard potassium permanganate. This single-precipitation method has been subjected to considerable criticism. In the methods just described the calcium oxalate is precipitated by adding a boiling ammonium oxalate solution to a *boiling ammoniacal* solution containing the calcium and magnesium. Table IX shows the results for CaO obtained by 12 different analysts on the same sample of cement. Each followed the procedure for the single-precipitation method [(sec. 35(*a*))[3] (par. F 18 b)[10]]; namely, precipitation by addition of boiling ammonium oxalate to a boiling ammonical solution, filtration and washing with 75 ml of hot water, followed by solution of the precipitate and titration with permanganate. The values shown are median values, generally of three determinations. The range shown in Table IX is, to say the least, disturbing. Some analysts have indicated that they were able to get more reproducible results with this method if they used filter paper of medium retentivity, added methyl-orange indicator to the precipitate on the filter, and then washed with hot water until the indicator color had disappeared. In this laboratory we have been unable to obtain any better results by the use of the indicator. We found the methyl orange was somewhat preferentially absorbed by the filter paper. Attempts to wash out the color, therefore, led to a tendency to wash the paper more than the precipitate. Furthermore, we have seen no evidence to indicate that there is any reason to believe that washing away the indicator color is any measure of the removal of excess ammonium oxalate.

Kolthoff and Sandell[11] give an excellent discussion on the subject of calcium oxalate precipitation. According to their work, it is much better to precipitate calcium oxalate by adding ammonium oxalate to a hot acid solution of the calcium salt and finally neutralize with ammonium hydroxide. They point out that a precipitate obtained by adding ammonium oxalate to a neutral or ammonical solution is contaminated with basic calcium oxalate, and decidedly low results are then obtained in the permanganimetric method.

Several years ago it was suggested by chemists of J. L. Gilliland's laboratory at the Bureau of Reclamation in Denver, that the Federal Specifications and ASTM Methods for precipitating calcium oxalate be revised in line with the findings of Kolthoff and Sandell. Work in our own laboratory has also shown the need for such action. The latest revision of the Federal methods (par. 4.3.5.1 and par. 4.3.5.2)[2] requires calcium oxalate precipitation by methods very similar to the recommended procedure of Kolthoff and Sandell. Because the ratio of Mg to Ca in cement is far less than the maximum provided for their method, the amount of ammonium oxalate has been reduced in order to minimize the possible interfering effect of large amounts of ammonium oxalate on the subsequent magnesium precipitation. This obviates the need for destroying a large excess of oxalate before precipitating magnesium. In the latest ASTM methods (Sections 13(*a*) and (*b*) and 35(*a*))[3] describe these same modified Kolthoff and Sandell procedures for calcium oxalate precipitation under an Editorial Note as a tentative revision (p. 99)[3] requesting comment before approval for incorporation in the Standard.

It is recognized that a double precipitation of calcium oxalate, followed by ignition to the oxide is the more accurate method of determining calcium. The great saving in time for acceptance testing purposes, however, makes desirable the use of the single precipitation procedure followed by permanganate titration. Accordingly, a study of the precision and accuracy of the latest revised procedure for its use was made.

TABLE IX.—RESULTS OBTAINED FOR CaO ON THE SAME SAMPLE OF CEMENT BY 12 ANALYSTS.

Single precipitation by addition of boiling ammonium oxalate to boiling ammoniacal solution, followed by titration of the acidified oxalate with permanganate (Sec. 35(*a*)[3], par. F18b[10]). Each value is a median, generally of three determinations.

Analyst	CaO, per cent
No. 1	62.35
No. 2	62.46
No. 3	62.24
No. 4	62.52
No. 5	62.81
No. 6	62.38
No. 7	62.12
No. 8	62.59
No. 9	62.28
No. 10	62.37
No. 11	62.28
No. 12	62.42
Average	62.40
Range	0.69

There is, at this date, no NBS chemical standard sample of cement. The nearest thing to it in composition is Standard Sample IA, Argillaceous Limestone, with average certificate values, among others, of 41.32 per cent CaO, 0.12 per cent SrO, 2.19 per cent MgO, and 0.038 per cent MnO. No attempt was made to separate the Ca and Sr in this work, so it is assumed that the Sr was quantitatively precipitated together with the Ca as oxalate. An ignition of the combined oxalate to CaO + SrO should be expected then to give an apparent value of 41.44 per cent for CaO. Permanganimetric titration of the oxalates should give slightly lower results because of the Sr present. The equivalent of 0.12 per cent SrO is 0.06 per cent CaO, $\left(=\frac{0.12 \times 56.08}{103.63}\right)$. Therefore the ideal value for permanganimetric titration would be 41.32 per cent + 0.06 per cent = 41.38 per cent for this sample.

As far as possible, the calcium was determined in Standard Sample IA according to the alternate method for cement (par. 4.3.5.1)[2] Because the material is not a cement, a few modifications had to be made and are described. A sample of sufficient size (about 0.75 g) was used to give the approximate amount of calcium found in a 0.5-g sample of cement. The limestone was ignited at 1100 C to produce a material similar to cement. This was then treated with hydrochloric acid, and the silica removed by double dehydration. The impure silica was ignited, volatilized with HF and H_2SO_4; the HF residue was fused with $K_2S_2O_7$ and dissolved. This solution was added to the original filtrate from the removal of silica. The R_2O_3 was removed by double precipitation.

[10] Federal Specification for Cements, Hydraulic; General Specifications, Methods for Sampling, Inspection, and Testing (SS-C-158b), May 20, 1946, superseded by Federal Specification SS-C-158c.

[11] I. M. Kolthoff and E. B. Sandell, "Textbook of Quantitative Inorganic Analysis," The Macmillan Co., New York, N. Y., p. 347 (1948).

Manganese was not removed. The calcium and strontium were then separated by a single precipitation by adding ammonium oxalate to an acid solution at 70 to 80 C followed by neutralization with ammonium hydroxide until methyl red changed from red to yellow. The solution was allowed to stand without further heating for 1 hr.

From this point on, four different methods of filtering and washing were used in an effort to see what difference, if any, this would cause in the results.

Group I.—Filtered through retentive paper. The precipitate on the funnel was treated with methyl-orange indicator and washed with hot water until the methyl orange disappeared (about 125 ml).

Group II.—Filtered through retentive paper and washed with 75 ml of hot water. This is the present Federal procedure (par. 4.3.5.1).[2]

Group III.—Filtered through paper of moderate retentivity. The precipitate on the funnel was treated with methyl-orange indicator and washed with hot water until the methyl orange disappeared (about 125 ml).

Group IV.—Filtered through paper of moderate retentivity and washed with 75 ml of hot water.

The results for CaO obtained by these different techniques are shown in Table X. All the results appear to be acceptable and there is little to choose among the effects of the different techniques of washing and filtering.

Twelve chemists determined the calcium in Standard Sample IA by the Federal procedure (par. 4.3.5.1)[2] as had previously been done by one chemist whose results are shown in Group II of Table X. The median result reported by each chemist (generally of three determinations) is shown in Table XI. The range of values is much smaller than that shown in Table IX where the same number of chemists determined the calcium in a sample of cement, precipitating the calcium oxalate by adding boiling ammonium oxalate to a boiling ammoniacal solution. The combined data of Tables X and XI when contrasted with those of Table IX show that the single precipitation procedure, as now described (par. 4.3.5.1)[2] gives satisfactory results.

TABLE X.—CaO VALUES OBTAINED ON NBS STANDARD SAMPLE IA USING SINGLE PRECIPITATION OF OXALATE. (par. 4. 3.5.1.2)[2]

Oxalate added to acid solution followed by neutralization at 70–80 C. SrO was not separated.

CaO, per cent[a]			
Group I Retentive Paper, Methyl Orange, 125 ml Washings	Group II, Retentive Paper, 75 ml Washings, Present Federal	Group III, Moderately Retentive Paper, Methyl Orange, 125 ml Washings	Group IV, Moderately Retentive Paper, 75 ml Washings
41.36	41.45	41.35	41.39
41.35	41.36	41.35	41.36
	41.38	41.41	41.38
	41.33	41.42	41.36
	41.34		
Average 41.36	41.37	41.28	41.37

[a] Certificate values of 41.32 per cent CaO and 0.12 per cent SrO. This amounts to a total CaO equivalent of 41.38 per cent.

Effect of Volume on Calcium Oxalate Precipitation

In the latest Federal methods (par. 4.3.5.1 and par. 4.3.5.2)[2] the precipitations of calcium oxalate are made in volumes of 200 ml. The latest ASTM (Section 13)[3] Standard method does not specify this volume, although in actual practice it is generally about 200 ml for the first precipitation under average conditions. Under the ASTM Alternate Method (Section 35(*a*))[3] the volume is not specified. Generally the volume of the filtrate and washings from the separation of the R_2O_3 is at least 300 ml and may be as high as 400 ml for some analysts.

Experiments were carried out to determine the effect of increased volume on the precipitation of calcium oxalate. It would certainly be a saving in time if evaporation to 200 ml were not necessary before use of the alternate method. Because the single-precipitation method is not considered as accurate as the umpire method and because the differences were expected to be small, a double precipitation was used to determine the effect of increased volume.

Eight determinations of CaO were made on each of two samples of cement by the Federal umpire method (par. 4.3.5.2)[2] precipitating the calcium oxalate both times in a volume of 200 ml. Average values of 62.52 and 64.92 per cent CaO were obtained. Then eight more determinations of CaO were made on each by the same method with the following exception. A volume of 400 ml was used for the first calcium oxalate precipitation, and 200 ml for the second. This set of determinations gave average values of 62.41 and 64.85 per cent CaO. Thus doubling the volume for one precipitation lowered the average values obtained for CaO 0.11 and 0.07 per cent. Manganese was not removed before any of these CaO determinations.

Generally the volume of the filtrate and washings from the R_2O_3 separation will not be quite as large as 400 ml. However, in view of these data evaporation to 200 ml appears to be advisable in the alternate method.

Summary

From the results of this study, the following conclusions are drawn concerning some of the operations involved in the analysis of portland cement:

1. Heating SiO_2 for 1 hr at 1200 C can reasonably be expected to give constant weight; platinum loss from pure platinum crucibles is negligible for this time and temperature.

2. Heating R_2O_3 for 1 hr at 1100 C can reasonably be expected to give constant weight; platinum loss is also negligible under these conditions. No evidence could be found to indicate that any appreciable reduction of Fe_2O_3 to Fe_3O_4 occurs during such heating if precautions are taken not to ignite over reducing gases.

3. For careful work it is better to ignite without allowing the filter paper to flame.

4. R_2O_3 should be heated at 1100 C to reduce its hygroscopic characteristics.

5. It would be advisable to increase the ignition time for the HF residue to 5 min to insure constant weight under all conditions of heating.

6. The use of platinum evaporating dishes for the double dehydration of silica gave slightly higher results than the use of porcelain casseroles or chemical pyrex beakers.

7. A single precipitation of calcium oxalate, followed by titration with permanganate according to the present alternate Federal method (par. 4.3.5.1)[2] gave acceptable results. The kind of filter paper used and volume of wash water were not critical.

8. The filtrate volume after R_2O_3 separation should be limited to 200 ml for calcium oxalate precipitation.

TABLE XI.—VALUES OBTAINED FOR CaO IN STANDARD SAMPLE IA, ARGILLACEOUS LIMESTONE, BY 12 ANALYSTS.

Modified Kolthoff method, single precipitation, $KMnO_4$ titration. Values reported are the median value obtained by each analyst (generally of three determinations). SrO was not separated. Certificate values of 41.32 per cent CaO and 0.12 per cent SrO, which is equivalent to a total of 41.38 per cent CaO.

Analyst	CaO, per cent
No. 1	41.30
No. 2	41.48
No. 3	41.41
No. 4	41.40
No. 5	41.36
No. 6	41.36
No. 7	41.44
No. 8	41.32
No. 9	41.30
No. 10	41.29
No. 11	41.27
No. 12	41.29
Average	41.35
Range	0.21

Sampling and Paintbrushes

By M. J. Snyder, L. L. Lortscher, and G. H. Beatty

SYNOPSIS

Random sampling plans are devised to produce an unbiased sample of the lot of material being sampled. The attempt is made to select the sample in such a way that all units in the lot have equal chances of being selected. The validity of the assumption that there is an equal chance of selection with any given plan is usually considered on the basis of the properties of the material and their interaction with the method employed. This paper describes experimental work which provided additional assurance of lack of bias in sampling of paintbrush fibers. Expected limits in the composition of random samples drawn from paintbrush fibers were predicted on the basis of the known composition of the brush. Samples of various sizes were drawn by the sampling procedure under test from mixtures of known composition. The compositions of the samples were determined and these values were compared with the predicted values. The compositions found fell within the predicted limits in 24 out of 25 cases, which is well within the expected deviation of 1 out of 20. The experimental testing of the plan thus supported the assumption that a random sample would be obtained.

Most statistical predictions made from measurements on samples are based on the assumption that the samples are random. By proper choice of the sampling conditions bias and nonrandomness can be minimized. This paper describes a method for sampling paintbrush fibers. Experimental studies of samples taken by the method support the assumption that random samples are obtained.

RESEARCH on the development of methods for determining the composition of the bristling materials in paintbrushes has been conducted at Battelle Memorial Inst. for a committee of the American Brush Manufacturers Assn. A part of this research involved sampling the bristling portion of a brush to provide a small sample that could be analyzed economically. If this sample were a random sample, statistical predictions could be made about the limits of the various bristling materials in the brush. Since it was essential to predict the composition of the brush with a high degree of confidence, experimental support of the randomness of the sample was highly desirable.

Paintbrushes composed of mixtures of horsehair and hog bristle were of primary interest in the studies undertaken. Thus, sampling of a discrete, twofold population was involved. A simple, manual mixing and sampling scheme was proposed which presumably should yield a random sample. The bundle of fibers taken from a brush was mixed by first laying it out into a long thin layer and then splitting the layer into three portions. One of these portions was selected at random and was laid out in a long thin layer; the other two portions were successively laid on top of the first portion. This series of operations constituted one mixing. After ten such mixings, the layer of mixed fibers was split into two approximately equal portions; one portion was selected by chance and was split in half and the procedure repeated until the desired size of sample was obtained.

With this procedure, each fiber in the original bundle should have an equal chance of ending in the final sample, and this sample would thus meet the requirements of a random sample. However, there is a question of segregation of smaller fibers and a possible difference in the handling characteristics of bristle and hair which would bias any sampling operation done by hand. Accordingly, it was desirable to have experimental support of the assumption of randomness. The experimental study was based on the following reasoning.

If samples are repeatedly drawn randomly from a mixture of horsehair and hog bristle, and the horsehair contents of the samples are measured (each sample is replaced before the next sample is drawn), the horsehair contents found will constitute a population having some mean $\bar{x}_h$ and a standard deviation σ_h. If the number of horsehairs and the total number of fibers in the original mixture are known, the values of $\bar{x}_h$ and σ_h can be calculated for any given size of sample. Using these

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L. L. LORTSCHER is Principal Chemical Engineer with the Chemical Engineering Division of Battelle. He has been closely associated with the development of a test method for identifying hog bristle and horsehair. He has also done development work on paintbrushes and metal polishing brushes which has stimulated interest in the application of statistical methods to produce development research and control problems.

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values, it is possible to assign limits to the horsehair content which should be found in a given sample. Thus, if a mixture of horsehair and hog bristle is made up in which the number of horsehairs and hog bristles present are known exactly, the expected limits (at any confidence level desired) within which the horsehair content of a random sample should lie can be calculated. Samples drawn by the mixing and sampling procedure in question should contain neither more nor less horsehair than the calculated limits if they behave like random samples. If more than 1 out of 20 of them is found to contain more or less horsehair than the calculated limits, the sampling procedure is not satisfactory. If less than 1 out of 20 have horsehair contents outside the limits, the assumption of randomness is supported and statistical predictions can be made with greater confidence.

Experimental Procedure

For ease in conducting the analyses, mixtures of white hog bristle and black horsehair were used so that the number of horsehairs in the samples could be determined by sorting and counting. Four different mixtures of hair and bristle were made up to provide different levels of horsehair content and different sizes of mixtures. Samples were taken from the mixtures by the method described previously, were sorted and counted, and returned to the mixture, which was then remixed preparatory to the next sampling. Data on the composition of the mixtures are given in Table I.

TABLE I.—COMPOSITION OF MIXTURES.

Mixture Identification	Total Number of Fibers, N	Fraction of Horsehair, p	Fraction of Hog Bristle, $1 - p$
A...	15 000	0.30	0.70
B...	10 000	0.01	0.99
C...	20 000	0.01	0.99
D...	20 000	0.10	0.90

Prediction of Limits

Since the brush mixtures from which samples are drawn constitute a discrete, twofold population, the hypothetical populations consisting of the infinite number of samples which could be drawn from each mixture have the form of the binomial distribution. The calculation of the probabilities of finding various horsehair contents in the samples would be an arduous task since extremely large numbers of fibers are involved. Fortunately, there are approximations that can be used and that do not introduce serious error. In certain cases, the distribution of the hypothetical population of samples

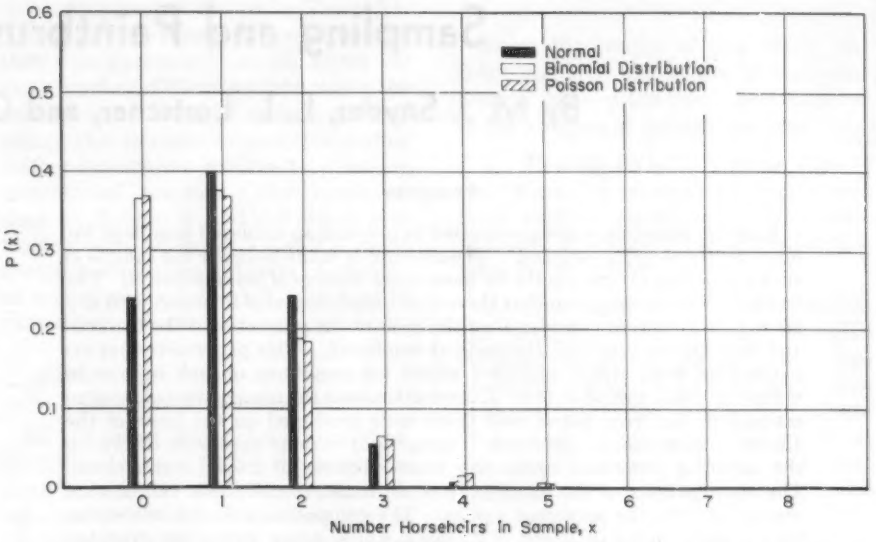

Fig. 1.—Comparison of Binomial, Normal, and Poisson Distributions for $p = 0.01$ and $n = 100$.

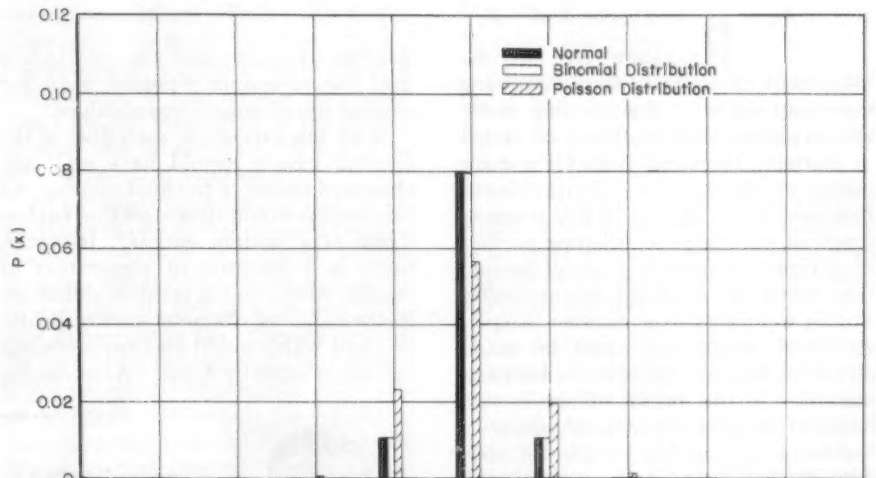

Fig. 2.—Comparison of Binomial, Normal, and Poisson Distributions for $p = 0.50$ and $n = 100$.

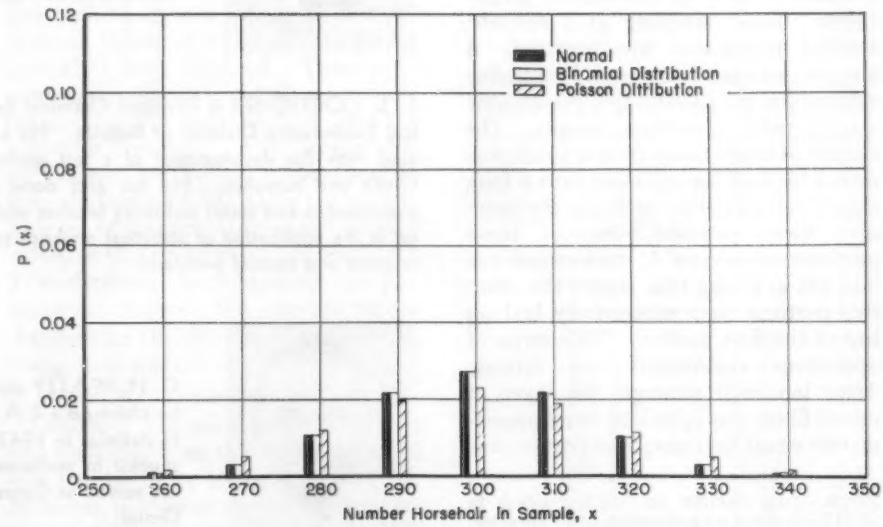

Fig. 3.—Comparison of Binomial, Normal, and Poisson Distributions for $p = 0.30$ and $n = 1000$.

drawn from a mixture is well approximated by a normal distribution; in other cases a Poisson distribution often is a better approximation. Qualitative criteria for deciding which approximation to use in a particular case have been given by various authors,[1] but in some cases these criteria leave considerable doubt as to which approximation is best. Accordingly, calculations were made of the probable limits for several representative bristle-hair mixtures and several sample sizes with a binomial distribution, the normal approximation, and the Poisson approximation.

The binomial distribution has the form:

$$P(x) = \frac{n!}{x!(n-x)!} p^x(1-p)^{n-x}$$

where $P(x)$ = the probability of exactly x horsehairs in a random sample of size n from a mixture in which the fraction of horsehair is p. Limiting values for x can be calculated by summing up the individual probabilities for various values of x and setting the limits as those values at which the sum of the probabilities equals 0.025 and 0.975. Thus, values within these assigned limits have a total probability of occurrence equal to 0.95. A similar procedure is used to assign limiting values using the Poisson approximation. The Poisson distribution has the form

$$P(x) = \frac{(np)x_e - np}{x!}$$

which simplifies the calculation somewhat. The use of the normal approximation eliminates the tedious individual calculations and summations. For the normal approximation, the mean is equal to p and the standard deviation is equal to:

$$\sqrt{\frac{p(1-p)}{n}\,\frac{N-n}{n-1}}$$

where N is the total number of fibers in the mixture. Thus, the expected limits are simply:[2]

$$p \pm 1.96 \sqrt{\frac{p(1-p)}{n}\,\frac{N-n}{n-1}}$$

Calculations by each of the methods showed that the normal distribution was the best single approximation to the exact binomial distribution in the range of fraction of horsehair and sample size of interest (1 to 50 per cent horsehair, 100 to 1000 fibers). Comparisons of the results obtained by the three methods for typical cases are illustrated in Figs. 1, 2, and 3. Because of the good fit of the normal distribution, the expected limits in horsehair content of each sample taken in the experimental work was calculated by use of the standard deviation of the normal distribution.

TABLE II.—CALCULATED LIMITS AND HORSEHAIR CONTENTS FOUND.

Sample	Mixture Used[a]	Sample Size, n	Predicted Limits in Horsehair[b]		Number of Horsehairs Found
			Lower	Upper	
No. 1..	A	1204	331	392	350
No. 2..	A	880	239	290	251
No. 3..	A	1147	314	374	369
No. 4..	A	1443	400	466	441
No. 5..	A	727	194	242	208
No. 6..	A	502	131	170	154
No. 7..	A	291	72	102	88
No. 8..	A	166	38	61	52
No. 9..	A	111	24	43	35
No. 10..	B	968	4	15	14
No. 11..	B	486	0	9	7
No. 12..	B	97	0	3	2
No. 13..	C	1302	6	20	14
No. 14..	C	1066	4	18	6
No. 15..	C	1291	6	21	19
No. 16..	C	512	0	7	5
No. 17..	C	512	0	7	2
No. 18..	C	716	3	10	5
No. 19..	C	99	0	3	1
No. 20..	C	176	0	4	6
No. 21..	D	1352	114	156	121
No. 22..	D	1234	103	143	110
No. 23..	D	984	80	116	83
No. 24..	D	571	45	69	64
No. 25..	D	472	35	59	40

[a] Compositions of mixtures are given in Table I.
[b] At 5 per cent level of significance.

Results

Data on the samples drawn from each of the four mixtures are given in Table II. In all except one of the 25 samples drawn, the horsehair content of the sample was within the predicted limits. At a 5 per cent level of significance, one sample out of 20 would be expected to fall outside of the predicted limits. Hence, the experimental results bear out the assumption that the sampling procedure yields a truly random sample.

Acknowledgment:

The permission of the Committee for Compliance with Government Regulations of the Paint and Varnish Brush Division of the American Brush Manufacturers Assn. to publish the results of this investigation is gratefully acknowledged. The authors wish to thank H. W. Northup and F. H. Schwartz, Jr., who did much of the tedious sorting and counting of fibers.

[1] For example, see J. G. Smith and A. J. Duncan, "Sampling Statistics and Applications," McGraw-Hill Book Co., Inc., New York, N. Y., pp. 186–219 (1945).

[2] At the 5 per cent level of significance, the confidence limits are ±1.96 standard deviation units from the mean value.

Papers on Non-Destructive Testing

The following three papers were part of a group of nine presented at a meeting of Committee E-7 on Non-destructive Testing at the 1953 Annual Meeting of the Society. These papers will be published as a special reprint. The other six papers include the paper by L. Tarr which appeared in the February BULLETIN, page 54; a paper by E. G. Cook and H. E. Van Valkenburg which will appear in the May issue; and four others which will not receive prior publication.

The Ultrasonic Testing of Forging Ingots

By Robert N. Hafemeister

Tests have proved that it is possible to determine the soundness of a forging by determining ultrasonically the condition of the ingot prior to forging. This paper describes the technique used to test three forging ingots.

THE forging industry has long felt the need of a rapid and reliable means of determining the soundness of the ingots to be used for making medium and large sized press forgings. If the head blacksmith knows of the existence and location of secondary pipe, or loose or porous center, the forging procedure can be changed or modified accordingly. If it could be possible also, under favorable conditions, to predict the soundness of a forging from the soundness of the ingot, a considerable amount of money could be saved in the elimination of scrap forgings by revising forging procedures, or, in the extreme case, by not using a particular ingot.

The two requisites for such a program were a reliable test and the availability of test ingots, neither of which existed. The facts that we purchase all forging ingots and hence have a quantity of properly thermal-conditioned ingots on hand and that there has been advancement in ultrasonic testing fulfill these requirements.

Proper thermal conditioning of the ingot has been mentioned. The main deterrent to testing in most plants is that, after casting and stripping, the ingot is held in the soaking pits at an elevated temperature. From the soaking pits the ingot goes directly to the forge furnaces where it is heated for forging. At no time are the ingots cold enough to be tested. But by purchasing ingots they are cold until needed for forging. This affords ample opportunity to test the ingot prior to any heating operation. Also, if need be later, the forging process can be stopped at any point, the ingot cooled, and a check test made after each heating or forging operation. By the use of proper records and coordination it would then be possible to predict the soundness of a forging, by controlling the important variables in the forging procedure.

Ultrasonic, non-destructive testing seemed to offer a solution to the testing problem. The test is rapid, inexpensive, and reliable, once the proper technique has been established. With no previous data to guide us, our original work was crude, entailing many rechecks to establish the reliability of the test. (At this point, we wish to emphasize clearly that these tests were not devised, and are not being used, to purchase or to force the supplier to furnish better ingots. Instead, they are being used in our shop as an aid to position forgings in the ingot, control top and bottom crop, check heating procedures, and to predetermine forging procedures.)

Originally the tests were made on 64-in. octagonal ingots. These were standard ingots that had been given a conditioning treatment by the vendor for the purpose of helping them withstand the cooling and reheating cycles necessary in our production.

In an effort to correlate the test with subsequent results, all forgings were made under the closest control and using the best forging practices possible. In this way, it was felt that any defects that might arise could be traced to ingot rather than forging conditions. Secondly, a procedure was established to inspect ultrasonically, as well as bore inspect, all forgings prior to as well as following heat treatment. It was felt that, through this system of cross testing, it would be possible to predict the reaction of any forging to subsequent handling—by knowing the condition of the ingot from which it was forged. For instance, secondary piping invariably led to forging difficulties and, in many instances, to scrap forgings.

After the proper technique of testing had been developed, and experience had been secured, predictions based on the ultrasonic test proved to be comparatively easy, if the accuracy of the test was relied upon.

During the past two years, approximately 30 ingots were examined sonically, varying in size from the 70-in. to the 48-in. size, in both alloy and plain carbon analysis. Several ingots required either additional regrinding of the surface or a slight variance of the testing technique.

Various problems and conditions can

ROBERT N. HAFEMEISTER, Foreman, Non-Destructive Testing Section, Allis-Chalmers, Milwaukee, has had 17 years' experience as a metallurgist. He spent more than 3 years gathering experience and data for sonic testing of forging ingots.

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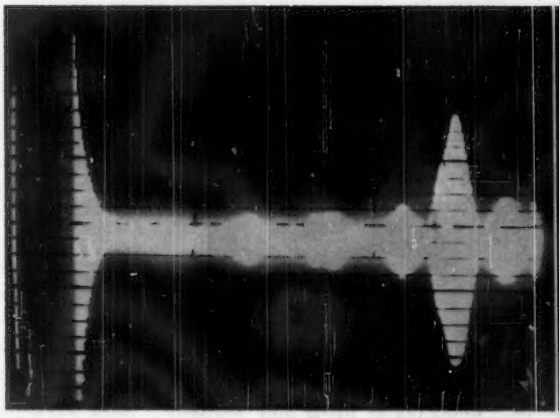

Fig. 1.—Shows the Back Reflection with Minor Indications. Hot top end.

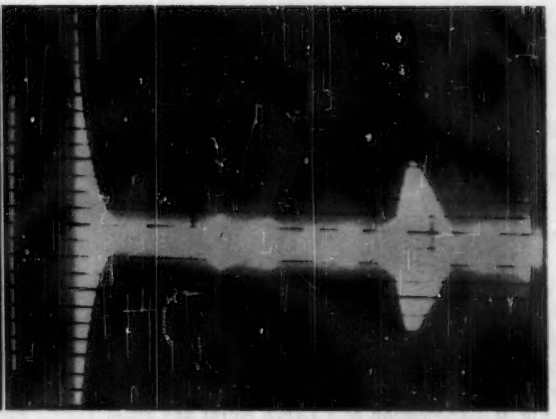

Fig. 2.—Same as Fig. 1, but from the Bottom of the Ingot.

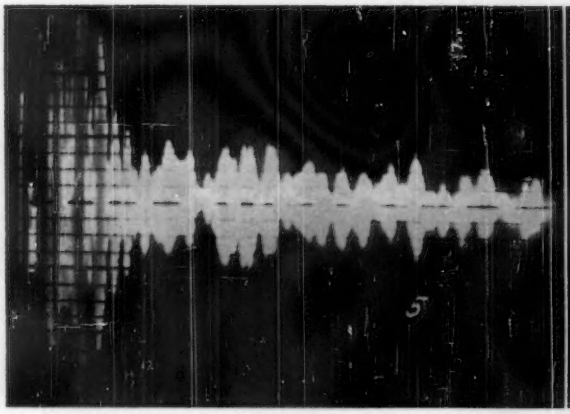

Fig. 3.—Lack of Back Reflection and Sharp Indications Indicate Porosity.

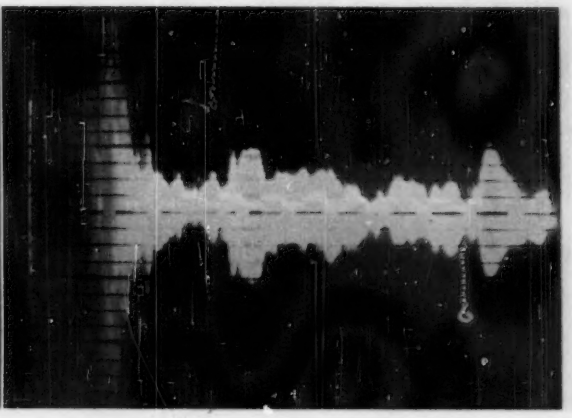

Fig. 4.—The Sharp Indication Between Initial Pulse and Apparent Back Reflection Indicates a Secondary Pipe.

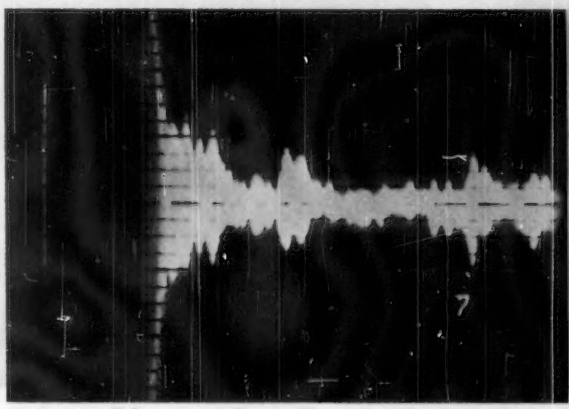

Fig. 5.—Same as Fig. 4, Showing Contination of Pipe in Fig. 4.

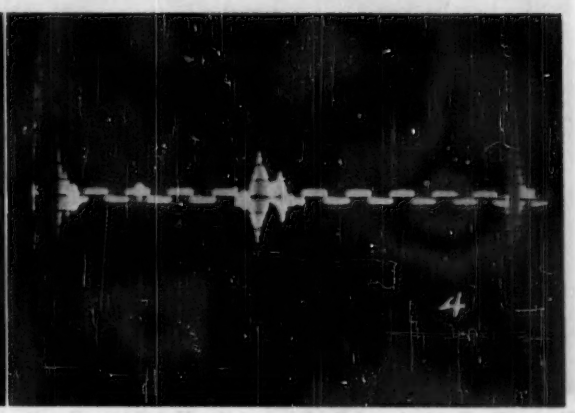

Fig. 6.—Indication of Small Forging Bursts at Center Line of Shaft.

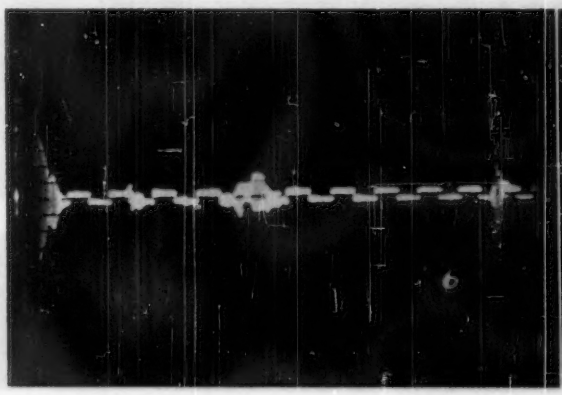

Fig. 7.—Indications of Porosity at Center Line of Shaft.

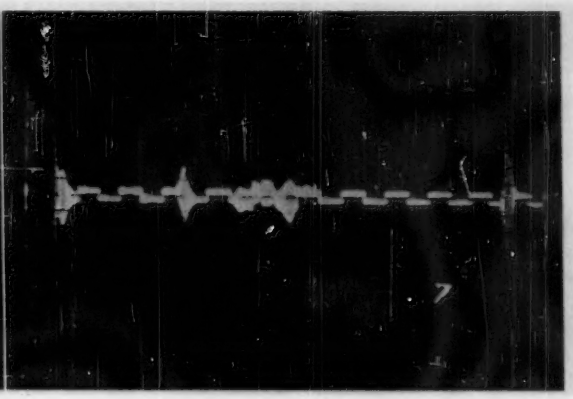

Fig. 8.—Indications of Porosity and Bursts.

Fig. 9.—Indication of a Large Burst at Center Line of Shaft.

Fig. 10.—Evidence of Burst and Porosity. Back reflection indicates 3-in. bore. Figures 10 to 12 confirm tests made prior to boring.

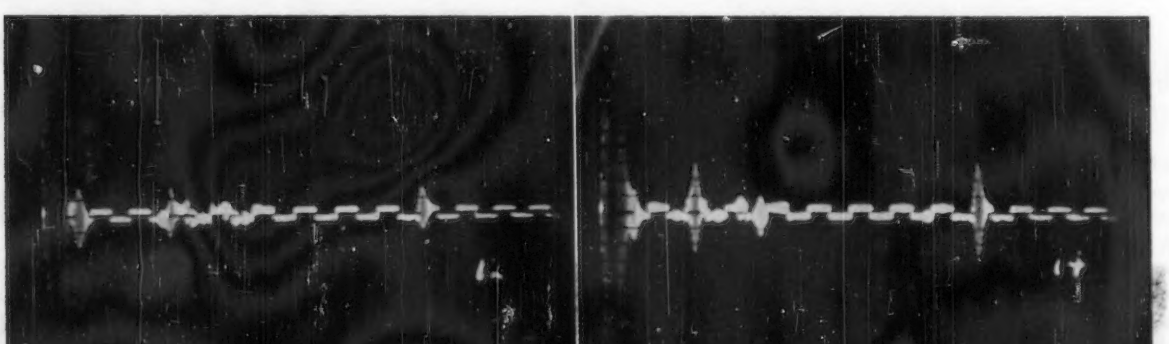

Fig. 11.—General Area of Fig. 10.

Fig. 12.—Further Exploration of General Area of Fig. 10.

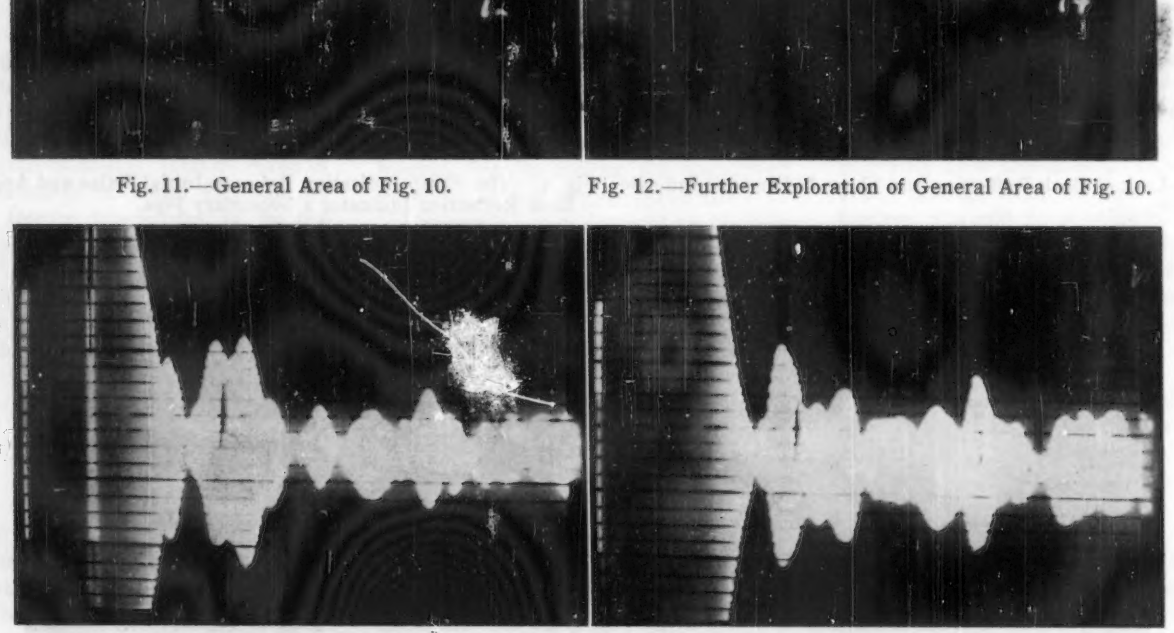

Fig. 13.—Shows No Evidence of Bridging at the Hot Top. Small pipe indicated.

Fig. 14.—Shows Evidence of Residual Pipe

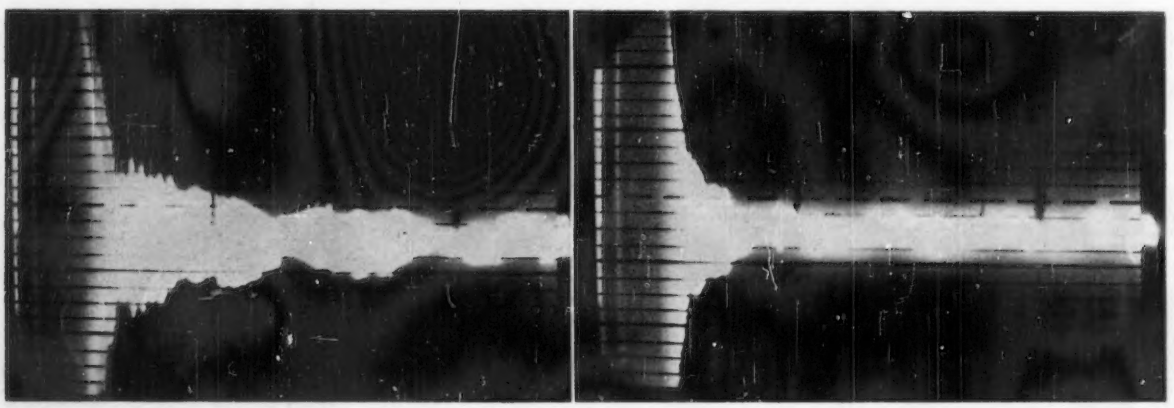

Fig. 15.—No Evidence of Pipe Remains. General porosity.

Fig. 16.—Evidence of Porosity Only.

arise. To illustrate, let us consider the investigation of a 64-in. octagon ingot, a 54-in. octagon ingot, and a 48-in. octagon ingot. All three ingots were made by the same manufacturer, and had received the same treatment prior to shipment. They all were medium-carbon alloy steel ingots (though various analyses do not affect the tests). Before testing, the surface of a location to be examined was prepared by grinding an area approximately 4 in. in diameter. All scale or other foreign material was removed from the surface. (The ground surface should be sufficiently flat to permit good crystal contact.) For the couplant between the searching unit and the metal face, a heavy bodied cylinder oil was found to be the most satisfactory. All tests were made with a type UR Sperry reflectoscope using a frequency of 0.5 mc.

Figures 1 and 2 show the trace on the cathode-ray screen of the reflectoscope for ingot No. 1, which was a 54-in. ingot. Figure 1 shows the area from the hot top; Fig. 2 shows the area from the bottom. The prominent back reflection with minor indications between the initial pulse and back reflection shows this to be a sound ingot with no evidence of porosity or secondary pipe. This ingot was forged in the normal manner and produced a sonically sound forging.

Ingot No. 2, a 64-in. ingot, was scheduled to produce a turbine rotor shaft. Figures 3, 4, and 5 show the trace on the cathode-ray screen of the reflectoscope. Locations of the wave paths were as follows:

21 in. from the hot top (Fig. 3)
52 in. from the hot top (Fig. 4)
25 in. from the bottom (Fig. 5)

In this case, center porosity and secondary pipe were noted. It was decided to forge the shaft, but a close watch was maintained at all times. Forging reductions were normal, that is, a minimum of 2.6 to 1; the heating-and-cooling cycles were very closely controlled. Trouble was encountered during forging. A rather large 8-to 10-in. long, transverse crack opened up approximately 28 to 30 in. from the step down at the hot top. This crack was cone shaped and of undetermined depth. After cropping the hot top, approximately 6 in. of the cone remained in the forging. A double upsetting was performed in an effort to obtain good consolidation.

After forging, the shaft was given a regular thermal protection heat cycle and annealed, prior to the first rough machining operation. After rough machining, the shaft was given a flash cut so that an ultrasonic test could again be made. Figures 6 to 12 show the result of the test. Locations of the areas tested on the finished shaft were:

24 in. from main body, in arm (Fig. 6)
27 in. from main body, in arm (Fig. 7)
22 in. from main body, in arm (Fig. 8)
18 in. from main body, in arm (Fig. 9)
19 in. to bore, 37 in. into main body (Fig. 10)
19 in. to bore, 36 in. into main body (Fig. 11)
19 in. to bore, 26 in. into main body (Fig. 12)

A 3-in. bore was put in the shaft to explore and give visible proof of the sonic test. Along with a considerable amount of open porosity, from pinhead size to $\frac{1}{4}$ in. in diameter, one large forging burst was found. The burst, as revealed by the 3-in. diameter bore, was approximately $2\frac{1}{2}$ in. wide and extended more than 3 in. transversely from the OD of the bore.

Ultrasonic exploration of the burst and porous area indicated the final bore would have to be at least $5\frac{1}{2}$ in. in diameter in the arm (with a bottle bore of 15 in. to remove the burst). Subsequently, the shaft was cut up, and the above dimensions were confirmed.

The results of ultrasonic testing on ingot No. 3, a 48-in. octagon, illustrates how prior knowledge of the internal condition of the ingot can be used to advantage in altering the forging procedure to produce a sound forging. The result of sonic test on the third ingot is shown in Figs. 13 to 16. Locations of the test areas were as follows:

20 in. from hot top (Fig. 13)
52 in. from hot top (Fig. 14)
39 in. from bottom of ingot (Fig. 15)
21 in. from bottom of ingot (Fig. 16)

In this case, there was no indication of a major secondary pipe, but there was extreme center porosity. This ingot was scheduled for a turbine rotor shaft of such dimensions that large forging reductions could be made.

After a careful study of the ingot condition, it was decided to use the ingot for the job scheduled but to change the recommended forging procedure. In this case, the shaft was given a single upsetting operation, but the total forging reduction was 3.5 to 1 through the diameter of the largest section. It was hoped that sufficient consolidation of the center would take place so that possibly a 2-to 3-in. bore would remove any residual center condition.

After the equalization and thermal protection heat-treating cycles, the shaft was rough turned and given a flash cut with a flat nosed tool. The finish resulting from this machining operation was approximately 90 microinches. The shaft was tested 100 per cent ultrasonically, transversely, and longitudinally, at 2.25 megacycles frequency. There were no significant sonic indications present in the shaft, and it was approved for use without boring.

The three cases mentioned in this paper are typical of the problems encountered. Thus, ultrasonic testing can be a great help to the forging industry if applied properly. The forge shop superintendent, forge shop metallurgist, and those doing sonic testing must be familiar with each other's work and problems. In this way the three parties can intelligently interpret the test and decide what action should be taken. Using ultrasonic testing in this way, a considerable amount of money can be saved in producing heavy forgings. At our plant, with such a program in effect, no ingots are being used unless they have been tested prior to forging.

We have not tested any ingots whose mean diameter is less than 48 in., but we are working on a program for testing some of the smaller sizes. A considerable amount of work remains to be done.

The Correlation of the Betatron with Other Forms of Non-Destructive Testing

By H. B. Norris

The author points out the increased value of tests such as magnetic particle, ultrasonic, and X-ray when used in conjunction with the betatron.

IN THE rapidly growing field of non-destructive testing, the advent of a new or improved type of testing machine has a marked effect on the application of all other equipment in the testing field. In the early days of non-destructive testing, engineers looked for a universal non-destructive test which in a single operation could determine the soundness of a piece of material. This viewpoint has changed. Now we try to *supplement* present techniques with newer ones to get more complete information. The importance of this change of viewpoint cannot be overemphasized in this day of increased stresses and decreased weights in metal products.

The Betatron

Among the newer pieces of non-destructive test equipment is the Kerst betatron. Although it is a type of X-ray machine, it will not replace all other X-ray units. We are using it as a machine which gives information beyond that given us by other types of testing equipment.

The betatron is a high-energy level X-ray machine, whose radiation easily penetrates over 20 in. of steel. Aside from this there are characteristics peculiar to the betatron due to the nature of the radiation it produces. With this radiation it is possible to obtain radiographs having sensitivities of about 0.5 per cent as indicated by the ASME Boiler Construction Code penetrameters. This degree of sensitivity is enhanced by the absence of scattering of the radiation, the minimized fogging of the film due to secondary and tertiary radiation, the high contrast, fine grain film that can be used, and the wavelengths of the radiation produced. With this equipment there is no longer the necessity for keeping object-to-film distances at a minimum, due again to the minimized scattering and fogging. Also it has been shown that the extreme latitude obtained results in single exposures of areas formerly requiring multiple exposures due to changes in metal section.

Equipment and Tests Used at Allis Chalmers

Recognizing that non-destructive test conditions vary from manufacturer to manufacturer, this discussion will of necessity have to deal with conditions that exist specifically at the Allis-Chalmers Co., although because of the diversification of products it should be possible to make comparisons with other industries. The non-destructive test equipment to be found at Allis-Chalmers includes the following:

1. Betatron—for high-energy level radiography in the 24 mev range.
2. Standard industrial X-ray units for radiography in the 50-to 400-kv range.
3. Magnetic particle testing units for both the wet and dry processes and for portable and stationary installations.
4. Ultrasonic testing units for casting and forging inspection.
5. Visual testing equipment such as fluorescent and dye penetrant tests and the borescope for the inspection of bores. In addition, the following tests are used in conjunction with the above-mentioned equipment in order further to check material soundness:
1. Pressure tests involving the use of air, water, or oil.
2. Electrical tests.
3. Performance tests.

At first glance it would appear that each of the pieces of test equipment mentioned would have its own specific application, but we have found that there is a definite overlapping and interdependence between them. Each unit performs a function of its own, but at the same time it complements the functions of the others.

Since the betatron is the newest piece of equipment among those in use at Allis-Chalmers, we intend to show its relationship to the others. We use over 12,000 tons of steel castings in a normal year, and some form of non-destructive test is applied to a large percentage of them. In addition to these castings, there are large quantities of both forgings and weldments which enter into our production scheme. These must all be inspected qualitywise. The extent of the application of the non-destructive tests on these parts depends on such factors as the operating conditions under which the piece being examined is intended to function, the effect of possible failure of the piece on the assembly, and the cost of examination.

Use with Magnetic Particle Tests

Our most commonly used test prior to the installation of the betratron was a magnetic particle test. This was particularly true with respect to our steel casting inspection. The value of this test lay in its detection of surface and subsurface discontinuities which might cause failure in service. But for castings subject to pressure or fatigue, this test was not always sufficient because of the possible existence in the castings of defects beyond the range of this test. Radiography improves the chances of discovering these defects. The betatron offers the most flexibility in an examination of this kind. Although neither test used separately gives a comprehensive result, applied together their results are reasonably conclusive. Surface defects found in a

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H. B. NORRIS became associated with the non-destructive testing field at the Allis-Chalmers Manufacturing Co., Milwaukee, where he has worked with radiography with radium, through lower energy X-ray radiography, magnetic particle testing, ultrasonic testing, and radiography with the betatron. At present, he has charge of the non-destructive test section of the inspection department.

casting or forging with magnetic particle methods are sometimes discovered to be acceptable when rechecked by the betatron. Conversely, defects found by the betatron when proved to be internal defects of the nonprogressive type by magnetic particle methods, may be acceptable.

Use with Low-Voltage X-ray

The betatron does not replace X-ray units of the 250-kv range at this time, although frequently both the betatron and the lower energy unit may be used in the radiography of a single assembly. Perhaps the best example might be in the radiography of complex sheet metal weldments for aircraft. Subassemblies on these parts can be successfully radiographed only with lower voltage X-ray units, but radiography of the whole assembly cannot be accomplished because of the scattering and the secondary radiation set up as the primary X-ray beam passes through the object. The betatron, however, can give a complete picture of the whole assembly with satisfactory definition if the accumulated thickness of material radiographed is over 1 in. Assemblies of all sorts having relatively thin sections are usually radiographed with lower energy units to discover defects in material but might be radiographed with the betatron to discover misalignment of parts within the assembly. Sensitivity in this case might be poor, but the extreme latitude obtained makes possible an over-all examination with but a single exposure. Again we see the application of the two machines complementing each other and one does not replace the other.

Use with Ultrasonic Tests

Betatron radiography and ultrasonic examination also can be used together in the inspection of castings. It is rather difficult to examine large complex castings with ultrasonic tests due to problems of changing contours and of making satisfactory crystal contact. Also, it is difficult in a number of cases to interpret correctly the sonic indications obtained. Castings have too many types of defects which can be classified only as discontinuities under an ultrasonic examination. On the other hand, when the sonic test can be applied it is much faster than radiography. Then, any sonic indications can if necessary be further checked with the betatron, eliminating an enormous amount of work and speeding production. Defects in castings discovered by means of the betatron and necessitating repair must be located with enough precision to make the repair work a minimum. This can be done by means of stereoradiography but is more quickly and easily done with the ultrasonic test.

The most common application of ultrasonics is in the examination of forgings. Here again, forgings found to be defective in an ultrasonic examination can be quickly checked with the betatron to determine the exact nature of the defect if the thickness range of the betatron is not exceeded. Formerly these indications were frequently checked by sectioning the forging so that a visual inspection of the defect could be made.

In many cases, standards must be established for specific ultrasonic tests. Perhaps the least expensive and time-consuming method of establishing these standards is to be found in radiography with the betatron. These standards of course should be established only for production involving large quantities. If the quantities involved are too small to set up such standards, frequently the two processes can still be applied. First, the total run can be sonic tested and then the pieces found to be defective can be radiographed. We usually mean radiography to be done with the betatron because most often the sonic test is applied to objects whose thickness is beyond the range of radiography with the lower energy X-ray units.

The ultrasonic test has suffered occasionally because of the difference in its presentation of data. Because magnetic particle tests and radiographic tests are somewhat easier to visualize, ultrasonics has not been used as a test in numerous applications where its application would have saved time and money. The betatron has helped in a number of instances in proving the acceptability of ultrasonics to those unfamiliar with that procedure but familiar with radiography.

Use with Visual tests

The remaining correlation is that between the betatron and visual tests. The betatron is often used to determine the extent of the defects found visually. These defects include those uncovered in a machining operation and those found by a regular test. To establish the need for repair as well as an estimate of repair expense, a complete analysis of the defect is necessary. If the defect is too extensive, repair might be impractical or even impossible. Also, use of the betatron may obtain the information needed to determine the best repair procedure.

The economics of non-destructive testing in general and of the specific test itself is extremely important. Management must have sound economic reasons before using any of these testing procedures. It is a known fact that non-destructive tests are used (1) when the product involved has to be proved sound, to give assurance that operation of that product will not be interrupted by failure of any component, and (2) when product improvement or lessening of cost can be accomplished through the use of one or more of these tests. Products in the aircraft industry illustrate the first use. Saving of material and saving of machine operations in the manufacturing process illustrate the second. Weight reductions made possible through a non-destructive test program not only lessen material cost but generally improve the operation or appearance of the product. The possibility of eliminating preliminary machining and testing operations with a non-destructive test program adds incentive to the use of such a program.

At Allis-Chalmers, the value of non-destructive testing is being realized increasingly. Part of this testing is done by radiography with the betatron. Correlation of the betatron with other equipment used has increased not only its own importance but that of all the other equipment involved.

Correlation of Gamma Radiography and Magnaflux Indications in the Inspection of Large Cast-Steel Connecting Rods

By R. L. Thompson

This paper presents an actual case history of the detection of severe shrinkage cracking in a large steel casting. A correlation between gamma radiology and the magnetic particle method resulted in greater information upon which an inspector could have based his final decision.

For the detection of a particular type of defect, it is advisable to consider the conditions which characterize that type of defect, and to choose a non-destructive test that is sensitive to one or more of its characteristics. In many cases it is possible to apply two or more different types of tests and to derive more information than with only one.

Shrinkage cracking is caused by stresses set up by differential cooling over a varying cross-section. This type of defect is characterized by a discontinuity which may or may not extend to the surface. The discontinuity may be a void or a tight crack, and the axes of the discontinuity may be of random orientation. The characteristics of this type of flaw are for the most part controlled by the conditions by which it was produced. Methods of controlling the cooling rate of castings during solidification are, in general, sufficient to insure against this type of defect.

However, in spite of the precautions taken, defects sometimes do occur. They must be detected and repaired, or the part must be discarded before it is placed in service.

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Fig. 1.—Grinding Repairs on Large Cast-Steel Connecting Rod.

In parts such as connecting rods, which are subjected to repeated stress reversals, stress raisers such as cracks are starting points for fatigue-crack propagation. During a routine Magnaflux inspection of large cast-steel connecting rods, one was found to contain shrinkage cracking in the web near the small end of the rod. This connecting rod was 55 in. long and weighed 565 lb. (see Fig. 1). Designed to carry relatively large loads, its failure in service might mean a major catastrophe. Therefore an attempt was made to establish the extent of the flaw—to determine the feasibility of repair.

Although this crack was not visible on the surface with the aid of a 5-power magnifying glass, the Magnaflux indications clearly showed that a crack was present (see Fig. 2). A portable-prod Magnaflux machine, Type KRH-2, and red Magnaflux powder were used for the inspection. The unit was operated at 1000 amp with the prods 3 to 4 in. apart. The spots can be seen where the prods were oriented to determine the maximum extent of the flaw.

Figure 3 shows a contact print of a gamma graph of the cracked area (actual relative densities are shown in reverse). The gamma graph was made with 300 mg of radium on type A film. It was exposed for 40 hr at a source-object distance of 45 in. A 2 per cent pentrameter was used (not shown). However, a 2 per cent sensitivity was obtained. It should be noted that the Magnaflux indications resemble only partly the indications shown by the gamma graph.

Fig. 2.—Magnflux Indication Prior to Exploration.

Figure 4 shows the much stronger Magnaflux indication after $\frac{3}{32}$ in. of steel had been removed by grinding. The indication, as shown by the Magnaflux powder only partly resembles the indication as shown by the gamma graph. At this point, the crack was faintly visible with a 5-power magnifying glass.

Figure 5 shows the Magnaflux indication after $\frac{3}{16}$ in. of steel was removed by grinding. At this point, the crack was clearly visible without a magnifying glass. The crack, which had resembled a half circle originally, on the surface,

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Fig. 3.—Gamma Graph of Area Containing Center-Line Shrinkage.

Fig. 4.—Magnaflux Indication After $^{3}/_{32}$ in. of Metal Was Removed by Grinding.

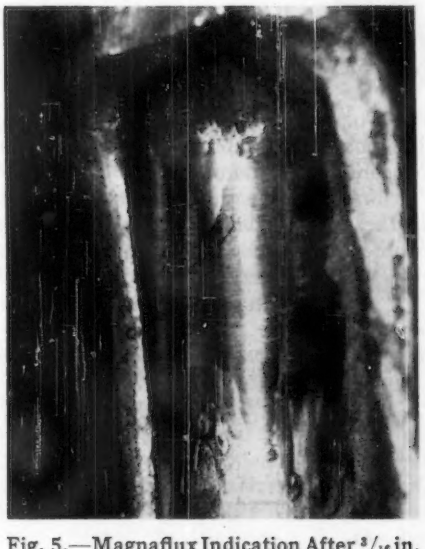

Fig. 5.—Magnaflux Indication After $^{3}/_{16}$ in. of Metal Was Removed by Grinding.

Fig. 6.—Magnaflux Indication After Removal of $^{3}/_{8}$ in. of Metal.

was beginning to disappear. The cracking which had appeared more as a straight line by the gamma graph was becoming evident.

Figure 6 shows the Magnaflux indications as they appeared after $^{3}/_{8}$ in. had been ground away. The cracking which had appeared as a half circle had then been almost completely ground away. The cracking as had been shown by the gamma graph was then plainly evident.

From the density contrast of the gamma graph, it had appeared that the crack extended through a considerable portion of the total thickness of the web. The thickness of the web at the point where the cracking occurred was $1\frac{5}{8}$ in. After grinding away $\frac{3}{8}$ in. in order to completely correlate the crack configuration with the indications as shown by the gamma graph, it was decided that repair was not economically feasible; the part was scrapped for remelt.

It should be realized that each nondestructive test has its limitations and in order to obtain maximum information it is desirable to utilize various types of test methods in an inspection. Since Magnaflux inspection is not capable of detecting defects lying far below the surface in a part, it is desirable to use a test such as radiography which will produce information concerning the internal conditions of a part. Gamma radiography should not be considered a replacement for Magnaflux inspection or *vice versa*. Each method of nondestructive testing has limitations and one should be used to augment the other.

Development of a Hiding Power Test Method—Report of Progress

By M. H. Switzer

Analysis of results obtained in cooperative testing of a proposed method for objective determination of hiding power of paints (Kubelka-Munk two constant theory) shows high precision and reproducibility should be obtainable after modifications have been made.

In a previous paper[1] there was described the origin of the present work of Task Group 10 on Hiding Power, of Subcommittee X on Optical Properties, of ASTM Committee D-1 on Paint, Varnish, Lacquer, and Related Products. The aim of this work was the development of a procedure for determining the hiding power of paints, which procedure would evaluate a paint in terms of spreading rate and contrast ratio rather than by comparison with a material reference standard (as in the present ASTM Method of Test for Relative Dry Hiding Power of Paints (D 344)).[2] Some of the problems in this development were stated, and a suggested method of test based upon earlier study by the Task Group was presented. Comments and criticisms of the method were solicited so that any basic changes required could be made prior to embarking on a study of the precision of the method.

Comments resulting from the discussion of the paper at the 1951 June meeting of Task Group 10 emphasized need for revision of the section of the procedure dealing with the freehand plotting of a curve of contrast ratio *versus* film thickness from which the values of contrast hiding index or spreading rate were to be interpolated. This method was not considered to have sufficient accuracy.

Accordingly, the equations of the Kubelka-Munk two-constant theory of light scattering were reviewed and organized into an analytical method for determining both spreading rate and contrast hiding index from the data developed by use of the hiding power test method. The development of these equations into a form suitable for use in the test method was described in a paper published in April, 1952.[3]

This analytical method was introduced into the test method in a revision dated January 17, 1952. As a result of discussion of this revision at a meeting in March, 1952, it was decided that suitably prepared paint samples should be submitted for test in accordance with it. Accordingly, replicate paint samples covering the gamut of high and low scattering and high and low reflectivity were sent out to each of four cooperating laboratories in May, 1952. The samples were prepared in the laboratories of the National Lead Co., Titanium Division, under the direction of A. E. Jacobsen. The four cooperators were: A. E. Jacobsen, M. P. Morse (E. I. du Pont de Nemours, Inc.), P. T. Howard (National Bureau of Standards), and A. Mac Leod (Dow Chemical Co.).

This report presents the interpretation of the test results obtained and offers recommendations for further modifications of the January, 1952, procedure. It is a condensation of a more complete report since the inclusion of the data and the details of the data analysis would result in a paper of such volume that publication was not possible. Since it was felt that the details are of permanent value and should be made available to those interested, arrangements have been made with the author that requests for reprints will be honored with multilith copies of the complete paper. Requests for the reprints should be addressed to ASTM headquarters.

General Character of the Test Results

The paint samples circulated to the cooperating laboratories were composed to be close to nonchromatic, no greater than a Munsell[4] Chroma 1 at any hue and value, and to provide: (1) high reflectivity and high scattering constant; (2) high reflectivity and low scattering constant; (3) low reflectivity and high scattering constant; (4) low reflectivity and low scattering constant. (Reflectivity is luminous directional reflectance referred to a freshly prepared magnesium oxide surface.[5,6]) Each laboratory received duplicate samples with respective codes A, A_1, B, B_1, C, C_1, D, D_1. Instructions accompanying the samples requested that each be subjected to the test procedure independently of all the others and that the test procedure be followed in all details.

At the March, 1953, meeting of Task Group 10, the spreading rate values obtained on the samples of paint in the four cooperating laboratories were discussed. On the whole, the results were reported as encouraging and the cooperators felt that adequate reasons could probably be found for such exceptions as did occur.

In this discussion, it was found that statistical control of the performance of the test within laboratories was remarkably good. No evidence was found in any case that the dispersion of

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[1] M. H. Switzer. "A Suggested Method of Test for Hiding Power of Paints," ASTM Bulletin, No. 175, July, 1951, p. 68 (TP158).

[2] 1952 Book of ASTM Standards, Part 4, p. 506.

[3] M. H. Switzer, "Equations for Calculating Contrast Hiding Index and Spreading Rate of Paints," ASTM Bulletin, No. 181, April, 1952, p. 75 (TP77).

[4] "Munsell Book of Color," Standard Edition. Munsell Color Co., Inc., Baltimore, Md. The chips for the colors of Chroma 1 are not given but may be interpolated between the colors of the chips for the nonchromatic value scale and the colors of the chips for Chroma 2. Also, Chroma 1 chips may be obtained from the Munsell Color Co.

[5] Standard Definition of Terms Relating to Paint (D-16), 1952 Book of ASTM Standards, Part 4, p. 555.

[6] Method of Test for Spectral Characteristics and Color of Objects and Materials (D 307 – 44), 1952 Book of ASTM Standards, Part 4, p. 534.

individual determinations within laboratories (measured by the standard deviation) was due to other than chance causes. The sample means, with one exception, also deviated within laboratories by amounts which could only be ascribed to chance causes.

Comparison of the spreading rates between laboratories from a statistical standpoint was also encouraging; the paint D results were the only ones which showed serious lack of control.

In view of the facts (1) that the paints varied from light to dark and highly opaque to light and dark highly translucent (paint B was like a milky varnish and paint D like a murky stain) and (2) that this was the first cooperative trial, with inexperienced people taking part in some cases, there seems to be good reason to believe that the test procedure contains the elements of good reproducibility and high precision. Accordingly, it was considered feasible to review further the procedure and the data to determine the assignable causes of variation that had occurred and to improve the precision of the determinations.

Results of Statistical Analysis of the Test Data

Within Laboratories Study—Reflectivity:

Since the test method requires several different types of measurement, a study was made to determine to what extent responsibility for low precision could be attributed to lack of accuracy in making the separate types of measurement. Reflectivity equations indicate that reflectivity[3] depends only upon photometric measurements; it is independent of the physical properties of the paint and of the hiding power charts over which the paint is applied (chart weight, etc.). Hence, the precision of the photometric measurements can be studied independently and later related to the precision obtained in determining the value of the scattering constant, s, which includes effects produced by the physical properties of the paint and the chart through the factor of paint film thickness.[1,3]

Statistical analysis[7] of the calculated values for reflectivity (R_∞) showed no instance of inconsistent performance in the determination within any of the laboratories on any of the four types of paint studied. These results are evidently independent of the level of reflectivity, at least within the range of about 30 to 90 per cent reflectance. They also seem to be independent of the type of photometer employed as well as the degree of experience of the operator; it has been reported that different makes of reflectometer were used and that the degree of technical training among the operators differed considerably. It should also be noted that the thicknesses of the paint films differed widely among the sample charts for each laboratory; the thinnest to the thickest film, in some cases, varied by a ratio of as much as about 1 to 3, and the low film thickness was generally in the range of 1.5 to 2.0 mils.

Between Laboratories Study—Reflectivity:

Study of the state of control between laboratories indicated that in only one case, the Paint D results, was the inconsistency due to excessive variation (large standard deviation). In all other cases, lack of consistency was due to means which exceeded the statistical control limits. However, even though lack of consistent performance between laboratories is shown, the spread among the mean values was not large; for paint A, the spread among laboratories for determinations of reflectivity was found to be 0.896 to 0.920; for paint B it was 0.432 to 0.450; for C, 0.724 to 0.738; for D, 0.296 to 0.337. This discrepancy is of the order of 2 to 4 per cent reflectance. The discrepancy might be due to (1) failure to correct for lack of linearity of response of the reflectometer accompanied by use of reflectance standards too far displaced from the reflectance of the sample, (2) nonuniformity in casting the films, or (3) dirt on the surface of the standard or sample chart. If it is due to one or all of these factors, attention to these details in performing the test should go far to establish consistent performance between laboratories.

Study of the Variation in Scattering Constant:

As with the reflectivity data, the scattering constant data showed no evidences of inconsistency within laboratories.

Only one case was found of lack of consistency between laboratories, which was due to a standard deviation exceeding statistical control limits. All the other discrepancies were due to high or low means. Lack of consistency among the laboratory means for paint D was so prevalent that no control limits could be expressed; this lack of consistency was evidently the cause of the lack of control among the values of the spreading rate for paint D described earlier in this report.

The standard deviations of the scattering constant values were found generally to be much larger than those found for reflectivity. The precision is evidently much lower in the determination of a scattering constant than it is in the determination of reflectivity, and even with this lower precision the means between laboratories deviate to an extent that the reproducibility must be classified as poor. Hence, for improvement in the over-all precision and reproducibility of the test method, the most fertile field for search is evidently in the determination of scattering constants.

In accordance with the equation for scattering constant, s, used in this procedure,[3,8] precision and reproducibility depend upon the precision and reproducibility of both the photometric measurements and the determination of the values of the film thickness. However, it has been demonstrated that the photometric measurements have a relatively high order of precision and that improvement in their reproducibility should be easily accomplished. Hence, it would appear that attention should be devoted to the determination of film thickness, T, to improve the precision and reproducibility of the scattering constant.

Reference to the equation for T[1] will indicate that the calculation of thickness requires the determinations of: (1) paint density, (2) the fraction of usable solids in the paint, and (3) weight of paint applied per unit of area. All the quantities, with the exception of the chart weight and weight of trimmed painted chart were based on the determination of one value per quantity for each paint sample; the chart weight and the painted trimmed chart weight were based on the determination of one value per test chart, or five values per paint sample. If the precision of determination is low for any one or more of the quantities for which single values were determined, the possible departure of this single value from the hypothetical true mean value could reflect this low precision throughout the calculations for scattering constant. It would therefore appear that some improvement in the precision of the determination of scattering constant could be obtained by the simple expedient of using the mean of replicate measurements for the density, for the solids, and control chart weight, untrimmed and trimmed.

The determination of paint density (or gallon weight modified by a conversion factor) involves use of equipment well known to the paint industry. However, a procedure for uniform use of the equipment has never been standardized and studied on a performance

[7] "ASTM Manual on Quality Control of Materials," p. 60 (1951). (Issued as separate publication *ASTM STP No. 15-C.*)

[8] P. Kubelka, "New Contributions to the Optics of Intensely Light Scattering Materials," *Journal*, Optical Soc. America, Vol. 38, p. 448 (1948).

basis. It has been tacitly assumed that such an apparently simple procedure as that involving use of a gallon weight cup required no specific delineation to obtain uniform and precise results. The hiding power procedure under study here is also based upon this possibly unjustified assumption. Although insufficient data were collected in this trial of the test method for a full statistical study of the variation of density within and between laboratories, a qualitative comparison of the values presented raised the question as to why the values for one laboratory should be generally the lowest for each of the paints and why those for a second laboratory should be generally the highest. Also, with such a simple procedure, why should a discrepancy as great as 0.032 exist in the density determinations on the two samples of one paint for the laboratory which has been pointed out as being out of control with respect to the standard deviation of *s*?

The first question might be answered by assuming lack of uniform calibration of the gallon weight cups among the laboratories; the answer to the second question very likely resides in nonuniformity among the laboratories in the manner of manipulating the equipment when making this determination. If these are the answers, it would seem imperative that the procedure for making the density determination be fully delineated either as an ASTM method or as an expansion of the hiding power procedure.

Only a partial statistical analysis was possible with the data provided for the determination of the paint solids. It was found that the estimate of the population standard deviation was 0.00985, indicating precision of the order of magnitude of that for the reflectivity. Hence, if this analysis and interpretation of the data are valid, it is improbable that the solids determination error has a major effect on the low precision and reproducibility in the determination of scattering constant. As a precautionary measure, however, the hiding power procedure should be revised to specify the amount of paint to be taken per unit of area of the glass plates, as is covered later in this report.

Dependence of Test Precision on Scattering Constant and Reflectivity:

To study the relationship between scattering constant and reflectivity in the combined effect on precision and reproducibility of the test method, means and the average estimates of the population standard deviations were calculated, based upon the data which showed results within control limits between laboratories. These estimates were based, where possible, upon those portions of the performance results which were homogeneous and thus are the best that are available at this time.

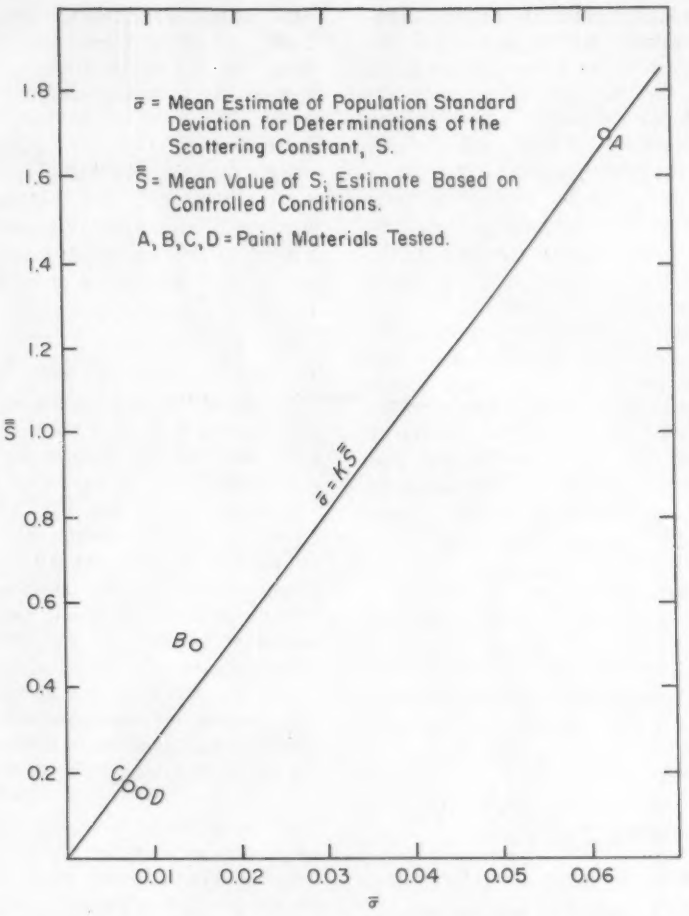

Fig. 1.—Relation of Test Precision, $\bar{\sigma}$, to the Paint Scattering Constant, *s*.

If the values of scattering constant, *s*, and its corresponding test precision, $\bar{\sigma}$, are plotted, the chart shown in Fig. 1 results. The straight line through the data (drawn free-hand) shows that the standard deviation of *s* is proportional to the value of *s*. Thus, as the value of the scattering constant of a paint becomes high, the errors of its determination become greater. If it can be assumed that this relationship is a straight line through the origin as shown, then any over-all improvement in the precision of determining *s* will be reflected proportionately all along the line. Hence, as far as the scattering constant alone is concerned, it is only necessary in the future to test cooperatively a paint with one level of *s* rather than the several levels referred to in this report. The one level selected should be in the high range, preferably, since this is the most difficult in which to obtain high precision and since satisfactory precision obtained here can be interpreted as satisfactory precision throughout all lower values of *s*.

Statistically, the coefficient of variation equals the standard deviation divided by the mean; if we let this quotient be the estimate of the population standard deviation for reflectivity divided by the estimate of the population mean for reflectivity, and then plot the quotient for each of the four paints *versus* the respective value of the population mean for the scattering constant, the chart of Fig. 2 results (curve drawn free-hand). The type form of the empirical equation for this locus is as given in the legend on the chart. Since a qualitative study of the interrelationship of the variables in this equation is adequate for this report, it was considered unnecessary to resort to the somewhat laborious procedure of solving for the values of the three constants in this equation.

Considering this type form equation, as reflectivity becomes large and scattering constant becomes small, the standard deviation of reflectivity becomes large; conversely, as reflectivity becomes small and scattering constant becomes large, the reflectivity standard deviation becomes small. For any one value of scattering constant, the standard deviation of reflectivity varies proportionately with the value of reflectiv-

ity; hence, the worst condition, from the standpoint of precision in the determination of reflectivity, occurs when the value of scattering constant is low and where the value of reflectivity is high. If satisfactory precision in the determination of reflectivity can be obtained under these conditions, then equal or better precision can be expected under all other conditions which might be imposed.

It can therefore be recommended that study of ways to improve the precision of the hiding power procedure with respect to scattering constant be conducted on paints with scattering constants similar to that of paint A in this investigation. Study of the precision with respect to reflectivity should be conducted on paints similar to paint C.

These facts will substantially reduce the amount of work involved in future cooperative testing for improvement of the precision. Unfortunately, the condition for poorest precision of the scattering constant (high value of s) is that in which most white paints fall. It is apparent, therefore, that considerable care must be exercised both in formulating the procedure and in executing its instructions in order to raise the precision to acceptable levels when employing the test on white or light gray paints, as it will be employed under normal circumstances.

On the other hand, it can be expected that the precision will be inherently better on dark gray or colored coatings (if the test is ever applied in modified form to the latter). Greatest precision will be found to be inherent in tests on dark coatings having high hiding, unfortunately, where there is little interest in hiding power.

Possible Sources of Error Which Appear in the Test Results

Noncompliance with Cooperative Test Instructions:

Some evidence was found that the duplicate paint samples were not in every case tested independently as was requested. Although it is unfortunate that instructions were not followed as closely as might have been wished, the results seem to indicate that other discrepancies have a larger effect than those caused by the failures to follow instructions. Hence, considering the purpose of the study it seemed best to ignore these failures. But it will be highly important if the procedure is revised and further trials made, that cooperating laboratories be fully cognizant of the need for strict adherence to the instructions.

Weight of Paint Used in Solids Determination:

Another possible source of error is in the use of an incorrect weight of paint on the glass slides in the solids determination.

In making this determination the film thickness must approximate that which occurs under use conditions for the paint so that test drying of the film will be the same as normal drying. The weight of paint specified in the procedure, 0.2 to 0.4 g, was intended to provide, on the glass plates of the area suggested, a film thickness which would assure through drying. It was evident from the test data that the plate areas which were used probably varied considerably. The same weight of paint applied on different areas will result in different film thicknesses.

The evidence in the data is not sufficient to indicate whether or not error was introduced into the solids determination by ambiguity of the procedure here (this has already been discussed in its relation to variation in the scattering constant). In any event, it has been considered wise to remove any possibility of misunderstanding by specifying the weight of paint to be taken per unit of glass plate area.

Nonuniformity of Film Thickness:

Although the variation of film thickness which occurred in the casting of the coating film on a single chart was not actually determined, in those cast films which approached 1 mil thickness, the variation over the surface of the chart was visually obvious and was probably an assignable source of error. The variation reported appeared to be due to the natural variation in the chart paper thickness resulting from fiber flocks in the paper structure. If this is the case, then the amount of coating film thickness variation should remain relatively constant regardless of the mean film thickness. Thus, as the mean film thickness increases, the amount of variation will become a smaller percentage of the mean, and conversely. Therefore, the variation should become visually unnoticeable at high film thicknesses and quite obvious at low, which is in accord with the descriptions reported.

Casting of the films was in all cases accomplished by use of a doctor

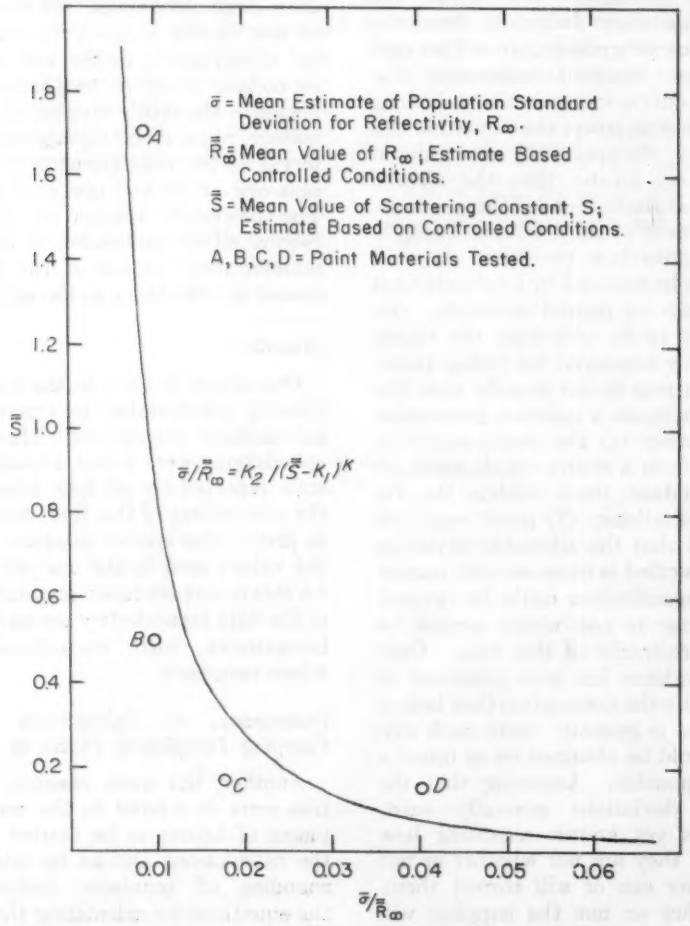

Fig. 2.—Relation of Test Precision, $\bar{\sigma}$, to the Combined Function of Both the Paint Scattering Constant, s, and the Paint Reflectivity, R_∞; see Text.

blade,[9,10] either automatic or hand operated. Since the supports for a doctor blade are at the ends of the film casting surface, a uniform film requires ideally that the surface on which the film is cast be a plane; any deviation from this will result in a like deviation in the thickness of the cast film. In the usual film casting operation on test charts, a plane base plate is used to which the test chart is held in close contact; the supports for the doctor blade ride on the test chart. If the chart thickness were uniform, then its top surface would be a plane and conditions necessary for uniform film casting would be satisfied. However, the charts are not uniform in thickness and it follows, therefore, that the doctor blade, when used as described, will inherently produce nonuniform film thicknesses on the test charts.

Three courses of action might be suggested: (1) an attempt can be made to obtain charts of uniform thickness; (2) film thicknesses used in the test procedure can be restricted to those levels at which the amount of variation is a sufficiently small percentage of the mean film thickness; (3) the possibility can be explored of developing a doctor blade or other film casting device which will avoid the need for assuming uniformity of thickness of the test charts.

The first course has the lowest possibility of success as long as the charts are made of paper; if some other material could be used, such as metal panels or foil coated black and white or black and white glass, there might be reasonable chance that the required uniformity of thickness could be obtained.

The restriction of the film thickness to higher levels where the amount of variation is a small percentage of the mean thickness is a satisfactory solution for materials with low to moderate opacity, but with very high hiding materials, high film thicknesses result in completely hiding films which provide data that are indeterminate with respect to spreading rate; hence, this course is not a general solution to the problem.

A device which might be suitable for investigation under the last course suggested is the wire-wound bar coater. In one form, this is composed of a piece of $\frac{3}{4}$-in. drill rod on the machined cylindrical surface of which is wound in adjacent turns steel wire of some selected gage. This wire-wound rod is pulled over the surface of the chart without rolling and with firm pressure against the chart. The support for the back of the chart is made somewhat resilient. The thickness of film cast by this method depends upon the size of wire used in winding the bar and on the viscosity of the paint. The adjacent turns of a wire in contact with the chart surface hold the surface gaged against the rod, the resilient backing for the chart taking up the inequalities of the chart thickness.

A fourth course, which has been held in disfavor, is the thinning of the paint to low solids so that a thick cast wet film will dry to the required low thickness. It is felt that this method is not sufficiently general in its applicability due to the tendency of many pigments to flock when excessive thinning is employed.

These various means of circumventing the problem of nonuniform films, as well as others that may be found later, will be considered in detail in the future work of Group 10.

Nonuniform Spectral Reflectance Distribution of the White Substrate:

One laboratory reported that it had found it impossible to abide by the test procedure requirement that the spectral reflectance distribution[6] of the white substrate throughout the interval 400 to 700 mμ show deviations from the mean value not greater than ± 5 per cent reflectance. Spectral reflectance distribution curves were submitted showing that the hiding power charts used in this laboratory dropped off an amount considerably greater than the allowed tolerance at the blue end of the spectrum. The inclusion of the tolerance limits in the test procedure was based on what seemed to be required by good judgment rather than on proved necessity. Assuming it to be true that the charts customarily employed for hiding power determinations do not comply with this stipulation raises a question answerable in two ways: (1) the charts might be obtained from a source which could reliably produce them within the required limitations; (2) proof might be developed that the allowable deviation as now specified is unnecessarily narrow and the specification could be revised. This matter is one which cannot be decided arbitrarily at this time. Only limited evidence has been presented so far to justify the assumption that lack of compliance is general; more such evidence should be obtained on as broad a basis as possible. Assuming that the excessive deviations generally exist, nothing is yet known regarding how consistent they are nor whether or not the supplier can or will correct them, nor whether or not the supplier will guarantee to maintain the charts within any specified tolerance limits, whatever limits are specified. This matter seems to deserve further study.

Nonlinearity of Response in the Photometric Scale:

The precision of the photometric measurements within laboratories appears to be sufficient to warrant the precautions necessary to assure maximum benefit of this precision in its effect on the values of $V_{0.98}$ or C_T'. During discussion among the cooperators at the group meeting in March, 1953, it was brought out that three of the laboratories had neither rectified the scale errors by means of calibration tables nor used photometric standards with reflectance values close to those of the samples being measured; that is, reference had been made to porcelain standards with reflectance close to 80 per cent. The fourth laboratory reported using reflectance standards close to the reflectance of the sample.

Due to manufacturing variability, it is safe to assume that the photometric scale of any reflectometer deviates from linear response. However, it is also well known that reflectometers are generally more reliable in detecting and measuring small reflectance differences between sample and standard than large differences. It was decided at the March meeting to enlarge the list of apparatus in the test procedure to include a set of 10 achromatic reflectance standards ranging in approximately equal steps throughout the interval 85 per cent through 15 per cent plus one at 10 and one at 5 per cent. The procedure should be revised to require either calibration of the reflectometer scale or use of the standard closest in reflectance to the sample.

Mistakes:

One source of error in the results was directly attributable to errors in the calculations themselves. Mistakes in calculations were found among the results reported by all four laboratories; the generalness of this fault would seem to justify this special emphasis. All of the values used in the analysis of data for this report are based on recalculation of the data presented by the cooperating laboratories with corrections made where necessary.

Inaccuracy, in Calculations Due to Carrying Insufficient Places of Figures:

Another, but more obscure, calculation error is related to the number of places of figures to be carried through the calculations and to be retained in rounding off numbers. Reference to the equations for calculating the optical constants[3] will indicate that the value of b is obtained by extracting the square

[9] Tentative Methods for Producing Films of Uniform Thickness of Paint, Varnish, Lacquer, and Related Products on Test Panels (D 823 – 51 T), 1952 Book of ASTM Standards, Part 4, p. 512.

[10] A. E. Jacobsen and H. S. Jensen, "Mechanical Operation of the Bird Film Applicator," ASTM BULLETIN, No. 151, March, 1948, p. 95 (TP103).

root of $(a^2 - 1)$. The sample paints having high reflectivity and high scattering constant gave values of a which differed from unity only in the third or more decimal places. Some of the calculations submitted by the collaborating laboratories were carried out at this point to the third decimal place only, thus providing a figure the square root of which was only a rough approximation to the true value of b. On page 47 of the ASTM Manual on Quality Control of Materials is presented a section on Number of Places to be Retained in Computation and Presentation. The recommendation is therein made: "In all operations [of computation], . . . retain the equivalent of two more places of figures than in the single observed values. . . . Rejecting places of figures [that is, rounding off] should be done after computations are completed, in order to keep the final results substantially free from computation errors." Since the reflectance values were determined to three decimal places, the computations should therefore have been carried to at least five decimal places.

The magnitude of a (and b also) is related to R_∞ in a fundamentally inverse manner. As the magnitude of R_∞ increases, the magnitude of a decreases, approaching unity as a limit (b approaches zero). Accordingly, it is with paint samples of high reflectivity that care must be taken to carry the calculation of a to a sufficient number of decimal places to be sure that the subtraction of unity in the equation for b will not result in serious errors in the atter. The highest reflectivity under discussion in this study was about 90 per cent. Assuming that all reflectance values are determined to three decimal places, the recommendation of the ASTM Manual will provide sufficient accuracy here and at all lower values of reflectivity; actually, sufficient accuracy is obtained with fewer decimal places in the computations at lower levels of reflectivity. However, it is conceivable that the procedure might be applied to paints of very high reflectivity where even five decimal places might not provide sufficient accuracy. Accordingly, it seems important that the procedure include a statement of precaution on this point.

Geometry of the Reflectometers:

A matter which must ultimately be considered concerns the geometry of the reflectometer; 45 deg irradiation and 0 deg viewing, the reciprocal, or the equivalent in performance is specified.[11] The Kubelka-Munk two-constant theory,[12] on which this test method is based, assumes conditions resulting from perfectly diffused irradiation of and reflection from the sample surface. The theoretical conditions satisfied by diffused irradiation are also satisfied by parallel irradiation at a 60-deg angle of incidence[8] provided the sample scatters the flux in a perfectly diffused manner. The samples that will be considered in studies of hiding power generally will not reflect strictly in accord with the assumptions on which the theory is based, since some of the irradiation will be reflected specularly from glossy samples and there is generally some goniophotometric inequality in the orientation of the reflected flux even in low-gloss samples. None of the reflectometers in general use employ this illuminating angle.

On the other hand, it may be that the difference between this ideal geometry and those generally employed has little practical importance. There is need here for weighing the theoretical validity of the procedure against the practical importance of the errors introduced by deviation from what theory indicates is ideal. Although much study has been devoted to the theory of light scattering and to the application of the theory to some classes of materials,[12] no well-defined procedure for application of the theoretical concepts to paints has yet received wide enough acceptance for any estimates to be available regarding its precision and reproducibility. A highly precise method with good reproducibility would be of distinct advantage in any study of the practical importance of these theoretical considerations. Therefore, it has been the purpose here to develop such a method on the basis of the theory insofar as theory could be applied; but where the ideals of the theory could not be achieved, the aim has been to develop a method nevertheless. The method, once developed, can then be used as a tool for weighing the practical importance of the departures from theory.

[11] Method of Test for Daylight 45-deg, 0-deg Luminous Directional Reflectance of Paint Finishes (D 771 – 47), 1952 Book of ASTM Standards, Part 4, p. 550.

[12] D. B. Judd, "Optical Specification of Light Scattering Materials," *Journal of Research*, Nat. Bureau Standards, Vol. 19, 1937, p. 287. (*RP* 1026.)

A Four Piece Steamer

By Marvin Antelman[1]

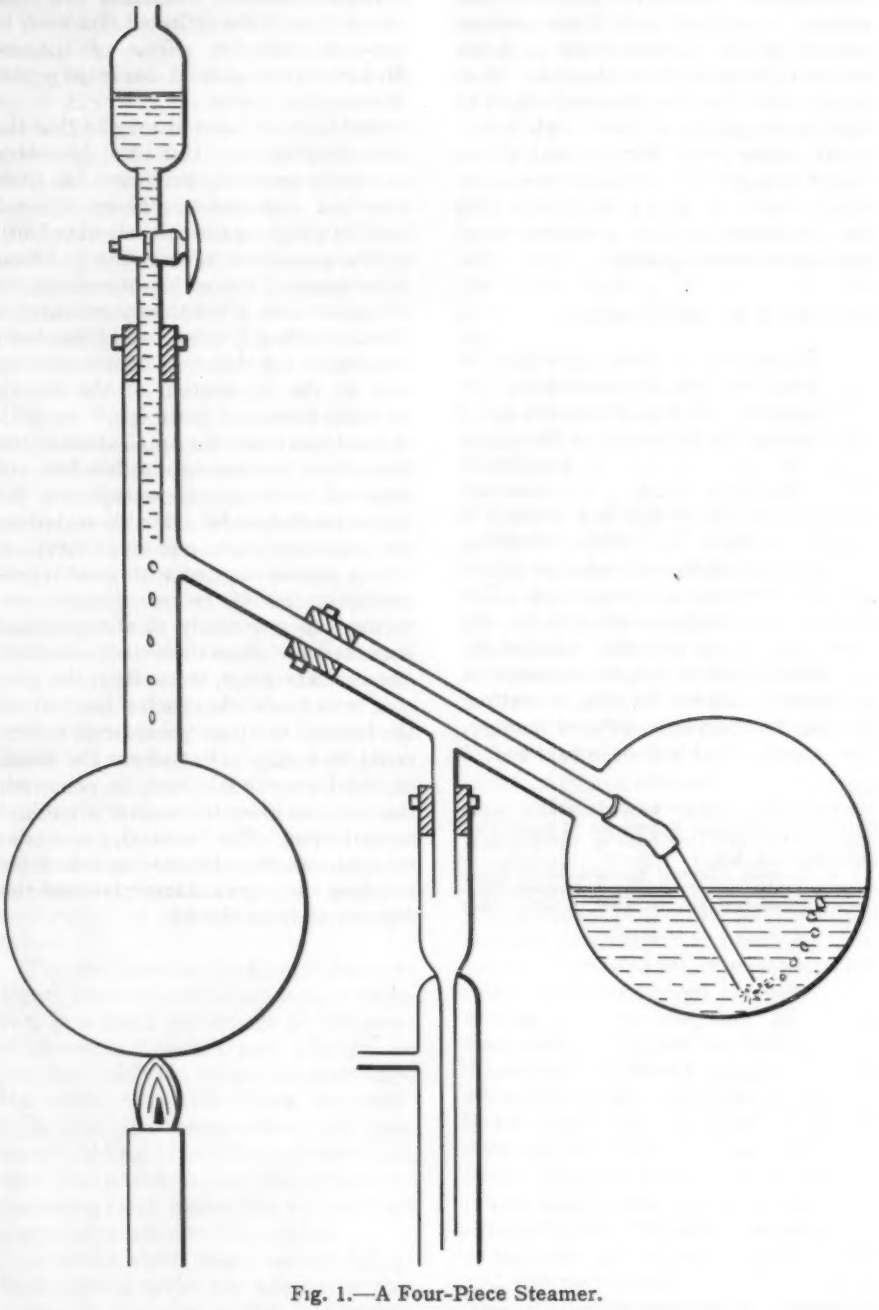

Fig. 1.—A Four-Piece Steamer.

MANY elaborate pieces of apparatus have been assembled for the purpose of steam distillation. They are excellent in many instances, but are generally too tedious to construct and take apart, or occupy too much space. The steamer described here consists essentially of four pieces of apparatus found in any laboratory: a separatory funnel, a Vycor brand distilling flask, a Pyrex distilling flask, and condenser.

Procedure:

To operate the unit, the separatory funnel is closed and filled with water; the Vycor flask should be empty. The second flask (Pyrex) should be filled with the liquid to be steam-distilled. The Vycor flask is heated for a few minutes. A few drops of water are then allowed to trickle on its hot surface by means of the pinchcock. The water immediately vaporizes to steam, the volume of which may be regulated by means of the pinchcock. As the water continues to drop, steam flows through the side-arm into the liquid. The vapors are then condensed and collected. Bored corks or stoppers may be replaced by ground-glass joints if one wishes to construct a single unit. In such a case the outer jacket of the condenser may be placed surrounding the flask's arm which may be lengthened. The first flask is constructed of Vycor glass because ordinary Pyrex glass cannot withstand the change in temperature of cold water falling on a heated surface.

[1] Yeshiva University, New York, N. Y.

The Evaluation of Chemical De-icing Solutions

By Carl Berger

Removal of ice is a critical problem in air and land transportation and in overhead power lines. The author has provided data of technical and economic value on the efficacy of de-icing solutions used in removal of frost or ice films.

THE removal of frost or ice films has been and is a critical problem in air and land transportation, overhead power lines, and other situations in which hazardous and costly icing may occur.

A number of approaches have made considerable inroads on the problem and have provided the needed solution to some of the above difficulties. Among these approaches are devices such as the rubber boot on airplane wings, the circulation of warm gases between layers of glass pane to provide better visibility, thermal devices, and chemical sprays. An interesting description of chemical and mechanical methods of de-icing was given by Arnhym in the *Aero Digest*.[1]

Chemical sprays have been employed in the past for de-icing purposes, and their current use continues to be vital in the aforementioned applications. The comparative potency of various de-icing solutions is therefore of much technical and economic value.

From a practical point of view there are a number of factors which influence the effectiveness of a de-icing spray These can be expressed as:

$$E = f(A, T_2, T_1, C, M) \ldots\ldots (1)$$

where:

- E = de-icing effectiveness,
- A = the surface area of ice or snow exposed to de-icing liquids,
- T_2 = temperature of the de-icing solvent or solution,
- T_1 = temperature of ice or snow,
- C = a variable representing a combination of wetting power and ice dissolution potential of the test fluid, and
- M = time that de-icing solution is in contact with ice or snow.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] A. Arnhym, "De-Icing and Anti-Icing Progress," *Aero Digest*, Vol. 46, Sept. 15 pp., 118–120, 144, 146 (1944).

TABLE I.—QUANTITATIVE AND QUALITATIVE PROPERTIES OF CERTAIN FLUIDS AS RELATED TO THEIR ICE DISSOLVING CAPACITY, C.

T_1 = 0 F, T_2 = 0 F, A = 9.63 sq in., M = 3 min.

	S	ΔS	C	V	K	H
Acetic anhydride	5.0	0.0	0.0	1	1	1
Amyl alcohol	5.0	0.0	0.0	2	2	2
Acetone	6.7	1.7	5.9	1	1	2
Methyl Cellosolve	7.2	2.2	7.6	1	1	2
Dioxalone	5.5	0.5	1.7	2	2	3
Butanol	5.0	0.0	0.0	2	2	1
Butyl Cellosolve	5.3	0.3	1.0	2	2	3
Cellosolve	6.2	1.2	4.1	2	2	3
2 Amino, 2 methyl, 1 propanol	7.4	2.4	8.3	3	2	1
Ethyl Carbitol	5.8	0.8	2.8	2	2	1
Glycerol	6.2	1.2	4.1	3	2	2
Isopropyl alcohol	6.2	1.2	4.1	1	1	2
Propylene chlorohydrin	5.4	0.4	1.4	1	2	1

The symbols have the following significance:

- S = total volume in ml of decanted fluid
  (The deviation of these values from ideality was checked by determining the volume of water remaining in the petri dish after decantation. The deviation was within the desired degree of accuracy for our work.)
- ΔS = amount of dissolved ice removed in terms of ml of H_2O
- C = dissolution potential of de-icing fluid expressed as ml of H_2O per sq cm per min $\times$ 100
- V = viscosity of fluid being tested expressed as:
  1 = mobile
  2 = viscous
  3 = very viscous
- K = qualitative expression of how fast test material spreads on surface of ice where:
  1 = fast spreading
  2 = average spreading
  3 = slow spreading
- H = qualitative expression of adherence of mixture of liquids to the ice upon draining where:
  1 = good adherence
  2 = average adherence
  3 = poor adherence

In order to establish a useful comparative criterion of ice dissolution ability, it was necessary to reduce the number of variables.

The variable A certainly would have many different values dependent on the nature of the deposited ice or the particular frost surface. We, therefore, eliminated this variable by the use of a standard ice surface of given area. T_1 and T_2 may be fixed at given values depending on the practical situation one is attempting to simulate on a laboratory basis, and M may be designated arbitrarily. The fixing of A, T_1 and T_2, and M leaves only C as a function of E, the de-icing effectiveness. The determination of C, therefore, was the actual laboratory problem.

Experimental Techniques

An ordinary petri dish, 3.5 in. in diameter and 0.88 in. in height, was used as the ice-containing receptacle. A pouring spout was notched on the upper portion of the dish.

The testing method was as follows:

A petri dish, into which 10 ml of water had been placed, was stored in a low-temperature cabinet at 0 F (T_1). (The time of storage is important, so that the desired cabinet temperature be reached by the ice.) The solvent or

CARL BERGER, Ice Physics Project Supervisor, Commonwealth Engineering Co. of Ohio, Dayton, has been working on a program in ice physics with reference to nucleation and crystallization of supercooled water, and the adhesion of ice and the development of an effective de-icing spray.

solution to be used for testing was also stored in the cabinet at 0 F (T_2).

Of the solution to be tested, 5 ml were withdrawn by pipet and drained onto the surface of the ice so that it covered the ice surface evenly. The petri dish was allowed to remain at 0 F for 3 min, and the supernatant fluid was then decanted into a graduated cylinder and measured immediately. The difference between the initial volume pipeted onto the ice and the amount decanted was an excellent relative criterion of de-icing potency of the test materials.

The only limit to the number of solutions tested was the space available in the low-temperature cabinet. All equipment, such as pipets and graduated cylinders, was stored at 0 F.

Duplicate and triplicate runs on a number of solvents indicated a reproducibility within sets of data of at least ±0.15 ml, a precision quite sufficient for our work. The use of stringent temperature control and calibrated volumetric apparatus would yield a higher degree of precision, if desired. Additional improvement could be obtained by corrections for the deviation of the total volume recorded, due to the nonideality of liquid in liquid solutions. The quantitative value of C for a number of organic liquids has been calculated and is recorded in Table I. Certain practical qualitative notations concerning the viscosity, V, of the test fluid at T_2, the speed of spreading, K, on ice, and the adherence, H, of the fluid to the ice surface have also been recorded.

The above technique can be used, of course, for ascertaining the de-icing potency of mixtures of solvents, the effect of adding water to de-icing solutions, as well as the effect of the addition of salts and other additives. T_1 and T_2 may be varied and the effect of any material throughout a range of temperature variation studied. With a little improvisation this technique could also be used for physical de-icing techniques such as infrared and sonics and would, therefore, serve as comparison of chemical and physical de-icing methods.

After C and the qualitative aspects of the problem have been considered, the ultimate circumstances in which the products of this research will be used should be brought into focus. These circumstances may include health hazards, damages to finishes, corrosion, and other practical considerations.

Precast Concrete Sandwich Walls

F. Thomas Collins, consulting engineer, San Gabriel, Calif., in his paper, "Design and Fabrication of Precast Sandwich Panels for Tilt-Up Construction," presented at the 50th Anniversary Convention of the American Concrete Institute said that there is evidence that the sandwich principle was used as early as 1849 in the construction of composite wood and concrete bridge decking.

The building industry for some years has used construction closely resembling sandwich panels in such projects as cold storage buildings and combination block and cast-in-place concrete walls. The development of precast concrete sandwich wall panels, however, is relatively new, said Mr. Collins.

The precast panels consist of two faces of relatively thin, high-strength, high-density materials (high-strength concrete faces), bonded to a core of relatively thick low-density material. The core material stabilizes the thin faces of high-strength concrete and provides a high stiffness factor for the combination by separating the faces. This combination, said Mr. Collins, produces a lighter, stronger wall; if the core material is a good insulator it also produces a more insulated wall.

The various types of sandwich materials used in concrete panels includes cellular glass insulation and plastic; foam concrete; compressed and treated wood fibers in cement; and lightweight concrete using vermiculite, perlite, pumice, and expanded slag and shale aggregates.

For the job-cast type of large tilt-up sandwich wall panel, Mr. Collins believed that the most economical and satisfactory filler material is lightweight concrete.

In comparing such a wall with that of regular concrete and common brick of the same insulation (heat transfer U factor of 0.22 Btu per hr per ft per deg F), Mr. Collins illustrated the advantage of sandwich construction. To achieve a U factor of 0.22, a regular concrete wall would have to be 35 in. thick; common brick, 15 in.; and a sandwich concrete panel using vermiculite concrete as the filler, 6 in.

As early as about 1906, sandwich-type tilt-up walls were tried, said Mr. Collins. A building in Des Moines, Iowa, was built by casting a 2-in. layer of concrete,, a 2-in. layer of sand, and then another 2-in. layer of concrete. The two outer layers of concrete were tied together with ties, and the sand between the concrete layers was washed out as the wall was tilted into place.

He then described various types of concrete sandwich wall construction now being used.

The "open-face" sandwich wall consists of panels with just two layers of material, a hard outer layer and an interior soft insulation layer. A typical wall would have 2 in. of regular concrete on the outside and 6 in. of lightweight concrete on the interior, which is usually plastered after installation.

A housing project at Great Lakes Naval Training Station, Chicago, Ill. used a 2½-in. layer of mesh-reinforced concrete on the outside, 1½ in. of Foamglas, and an inner layer of 4-in. mesh-reinforced concrete to achieve the sandwich effect.

Another panel, used as cladding for the steel frame of industrial buildings, was composed of two outer layers of 1¾-in. mesh-reinforced concrete. The center insulation was a 1½-in. lightweight precast slab of chemically mineralized wood chips.

The panel used on Columbia Cellulose Co., Ltd.'s pulp mill in British Columbia consisted of a 2-in. layer of cellular glass insulation and two mesh-reinforced slabs of 3000-psi concrete, tied together with channel-shaped strips of expanded metal.

One of the few true tilt-up sandwich wall panels, Mr. Collins believed, is one recently developed in Sweden. This panel is composed of 2-in. outer shells of regular dense concrete with 4-in. of lightweight expanded shale concrete between. Mr. Collins claimed that by precasting such panels at the site and tilting them up into position, costs would be from one-half to two-thirds those for smaller sandwich panels using expensive insulative material. Swedish builders have found that for buildings with ordinary inside humidity there seems to be no need for a vapor barrier, provided good dense concrete is used in the inside and outside layers.

Mr. Collins believed that the ideal precast concrete sandwich panel is one that incorporates prestressing in the outer shells. This would not be feasible for panels smaller than 10 by 10 ft, he said. However, it would be economical and feasible for the three-story tilt-up panels that are possible today, he emphasized. In southern California, he noted, 20 ft wide and 30 ft high tilt-up panels are not uncommon; several buildings have used 35 ft high panels.

The Bookshelf

Betz Handbook of Industrial Water Conditioning

W. H. and L. D. Betz Co., Gillingham and Worth Sts., Philadelphia, Pa., 248 pp., $3

THE subject matter in this Handbook is presented in a direct, simple, and easy-to-understand form. The introductory chapters deal with basic water treatment processes such as aeration, coagulation, softening, etc. The following chapters are concerned with specific water problems, particularly problems encountered in boiler water and cooling water conditioning. Applications and limitations of various water-treating equipment and methods are covered in detail.

To guide plant engineers and chemists in handling and supervising water conditioning operations, a supplementary section is devoted to control water analyses and their interpretation. The Handbook has been carefully organized for quick reference or easy study in any or all phases of industrial water conditioning.

Sample listings from the Table of Contents are as follows: Water and Its Impurities, Aeration, Filtration, Chlorination, Iron Removal and Iron Retention, Sodium Zeolite Softening, Demineralization, Acid Treatment of Boiler Feedwater, Chemical Feed Systems, Steam and Condensate Return Line Corrosion, Embrittlement of Boiler Metal, Chemical Cleaning of Boilers, Slime and Algae Control, Industrial Waste Treatment.

The supplementary section on Water Analyses deals with the impurities in water, a discussion of these impurities, how they originate, and how they can be controlled. Methods of analysis designed particularly for plant control are discussed in detail. General chapters on methods and equipment, expression of analytical results, and composition of prepared reagents are covered in addition to detailed descriptions of procedures for some 25 determinations.

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Materials Survey—Tin

Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., $4.25

THE Materials Survey series is being prepared under the sponsorship of the National Security Resources Board in cooperation with governmental departments and agencies. Studies on zinc, lead, and copper have already been published. This volume, dealing with tin, has been prepared, under the direction of the National Production Authority, by the Division of Mineral Economics of The Pennsylvania State University.

The Tin Survey provides a relatively detailed textural and statistical study of the various phases and activities, past and present, of the tin industry. The first chapter of the report deals with the physical and chemical properties of tin. Succeeding chapters deal with geology, world reserves, mining, smelting, and refining, production, uses, prices, marketing, national and international controls, followed by an appendix which discusses the various aspects of the tinplate industry.

Each chapter and the appendix is followed by a bibliography of sources from which most of the information contained in it was obtained and from which further details may be added. A general bibliography is given at the end of the volume. Appropriate tables, maps, charts, and figures are included as necessary to supplement and amplify the text.

The report is in loose-leaf form and is paged by chapters to facilitate future revisions. Space has been allowed on all basic tables and charts for the addition of data up through the year 1956.

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Mass Spectroscopy in Physics Research

National Bureau of Standards *Circular* 522, U. S. Government Printing Office, Washington 25, D. C., 280 pp., $1.75

THIS booklet contains a collection of all papers and pertinent tape-recorded discussion from the symposium which was one of a series of 12 commemorating the semicentennial of the National Bureau of Standards. Fifteen of the 35 papers are by authors outside the U. S. but all are in English.

The topics cover advances in mass spectroscopy of particular interest to physicists. The theme of all papers and discussion is that of fundamental research. However, a few topics are on the borderline of applied interest. M. J. O'Neal's discussion of mass spectra of heavy hydrocarbons was essentially an abbreviated version of his earlier paper (with T. P. Wier, Jr., *Analytical Chemistry*, Vol. 23, pp. 830–843 (1951)). C. E. Berry discussed high resolution in conventional mass spectrometers and described an ion-optical method to improve resolution to 1 part in 700. H. W. Washburn, *et al.*, described instrumental problems encountered in mass spectrometer isotope analysis of water samples. Their observations of adsorption and elution effects found for water and alcohols under varying instrumental conditions are recommended reading for any analyst using a mass spectrometer for analyses of liquids as well as those concerned with measuring deuterium concentration. Several papers summarize isotopic abundance data, some of which are related to geological age and the distribution of isotopes in nature.

F. P. HOCHGESANG

Air Pollution Abatement Manual—Chapter 10

Manufacturing Chemists' Assn., 15th and H Sts., N. W., Washington, D. C., 29 pp., 60 cents

As a part of its continuous and long-range program to eliminate air pollution that results from industrial processes, the Manufacturing Chemists' Assn. recently published Chapter 10 of its Air Pollution Abatement Manual. This installment, prepared by R. J. Jenny of the American Cyanamid Co., deals with gas and vapor abatement.

In the early sections of the chapter, methods of abatement of gases and vapors are treated. Some of these are: waste dispersal by the use of stacks; employing absorbers or scrubbers which, in effect, soak up the gas or vapor; incineration; catalytic combustion, and adsorption, which is the term used to describe the physical operation of a gas or vapor adhering to a solid substance.

Cutaway drawings illustrate several of the fundamentals involved in such abatement devices as packed towers and plate towers.

All of the material in this publication is the result of practical studies of proved methods of reducing atmospheric pollution. For those who wish to explore the subject further a complete bibliography is included.

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Statistical Quality Control and Acceptance Sampling

Ordnance Inspection Handbook ORD-M 608-9. U. S. Army Ordnance Corps. March 1952. 103 pages, with tables and charts. $2. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

AID to shops setting up quality control programs is offered in a a volume which reviews some of the fundamentals governing sampling procedures and gives reasons why it is possible to use certain steps in quality control without risking too much error.

Procedures in the successive selection of a predetermined number of samples are presented as well as a study of purely statistical methods, useful in the ready understanding of test data obtained by sampling. Tables illustrate a simple way of tabulating and classifying measurements into groups.

Methods are described which should aid in the ready understanding of such test data as obtained by statistical sampling, and numerous tables are shown for a quick grasp of dimensional variations. All these are to aid inspectors in tabulating and classifying measurements into a class to which they belong.

PERSONALS...

News items concerning the activities of our members will be welcomed for inclusion in this column.

NOTE—*These "Personals" are arranged in order of alphabetical sequence of the names. Frequently two or more members may be referred to in the same note, in which case the first one named is used as a key letter. It is believed that this arrangement will facilitate reference to the news about members.*

At the 50th Annual Convention of the American Concrete Institute in February in Denver, Colo., **Charles H. Scholer,** Head, Department of Applied Mechanics, Kansas State College, Manhattan, Kansas, was elected President for 1954. A member of ACI since 1924, Professor Scholer serves on a number of its committees. He has been affiliated with ASTM since 1925, rendering valued service in the technical groups concerned with cementitious, concrete, and masonry materials. Other ACI officers announced at the recent meeting included the following ASTM members: **H. C. Ross,** Assistant Director of Research, Hydro-Electric Power Commission of Ontario, Toronto, Canada; and **George W. Washa,** Professor, Department of Mechanics, University of Wisconsin, Madison, Wis.—both elected to three-year terms as Directors. **Charles S. Whitney,** Partner, Ammann and Whitney, New York City and Milwaukee, Wis., elected for a two-year term as Vice-President in 1953, continues in that post. **Alden M. Klein,** Assistant Manager, New York District, Robert W. Hunt Co., New York City, received the ACI Construction Practice Award jointly with J. H. A. Crockett, Civil and Structural Engineer, of London, England, for their paper, "Design and Construction of a Fully Vibration-Controlled Forging Hammer Foundation," which appeared in the January, 1953 *ACI Journal*. The Construction Practice Award was established by ACI in 1944 to recognize the man on the job for his resourcefulness in translating design into the completed structure.

Merrill Alden, for many years Technical Supervisor, The American Brass Co., Buffalo, N. Y., has retired. **Arthur W. Kuhn** succeeds Mr. Alden as Technical Supervisor at the Buffalo branch.

A. V. Baber, formerly Manager of Insulation Sales, Owens-Illinois Glass Co., is now Sales Manager, Tectum Corp., Newark, Ohio.

Aaron B. Bagsar has retired as Chief Metallurgical Engineer, Sun Oil Co., Marcus Hook, Pa., after 22 years with the company.

O. A. Battista, Group Leader, Chemical Research Dept., American Viscose Corp., Marcus Hook, Pa., and recently appointed Chairman of Subcommittee H on Cellulose of ASTM Committee D-23 on Cellulose and Cellulose Derivatives, has also been named Chairman of the Standards and Methods of Testing Cellulose Division of the American Chemical Society.

Oliver P. Beckwith has joined the Staff of the Fabric Research Laboratories, Inc., Boston, Mass. He was formerly Director of Quality Control and Chief of the Product Engineering Laboratories for Alexander Smith & Sons Carpet Co., Inc., Yonkers, N. Y. Mr. Beckwith will be in charge of a newly created quality control group, the purpose of which is to provide a consulting service in the field of quality control to industry. In ASTM he is Secretary of Committee E-11 on Quality Control and Chairman of the Section on Wool Fiber of Committee D-13 on Textiles.

H. C. Bugbee, until recently Vice-President of the Natural Rubber Bureau, Washington, D. C., has become President of the organization. Before joining the Bureau in 1947, Mr. Bugbee spent many years in Malaya in charge of B. F. Goodrich's Singapore office, and in Akron as Manager of Goodrich's Rubber Purchasing Division.

Lee S. Busch, of the Mallory-Sharon Titanium Corp., Niles, Ohio, has been appointed to serve on the Subcommittee on Heat Resisting Materials of the National Advisory Committee for Aeronautics.

John F. Calef, Chief Chemist, Automatic Electric Co., Chicago, Ill., is the twentieth winner of the Talbot G. Martin Award, presented by his company annually in recognition of contributions to the art of automatic telephony. Mr. Calef's citation recognizes his "leadership in inquiring into new materials and processes and in adapting them to practical needs which has done so much to further the quest for perfection in Strowger Automatic Equipment." Mr. Martin, for whom the award was named in 1934, and who was Chief Engineer of the Automatic Electric Co. for many years prior to his death in 1935, was instrumental in orginating many of the ideas now used in automatic telephony, having held about 200 patents. Affiliated with ASTM since 1921, Mr. Calef is a Past-Chairman of the Chicago District Council, and participates in a number of the technical committees. He has continued active in the District work for many years, and is currently Chairman of the Information Center Committee for the forthcoming Annual Meeting of ASTM in June.

T. W. Culmer, for many years Chief Chemist of the Ohio Oil Co., Robinson, Ill., has retired. **Glen C. Templeman** succeeds Mr. Culmer as representative of the company membership in the Society.

Edgar H. Dix, Jr., Assistant Director of Research, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa., is recipient of the 1954 Frank Newman Speller Award of the National Association of Corrosion Engineers, in recognition of achievements in corrosion engineering. Mr. Dix's major interest has been in the development of aluminum and magnesium alloys to meet specific industrial uses, an important consideration being the effect of metallurgical structure on the resistance to corrosion and stress corrosion, and the control of structure by composition and thermal treatments to obtain maximum resistance. A member of ASTM since 1919, Mr. Dix has been very active in a number of the non-ferrous groups and in Committee E-4 on Metallography.

Leslie S. Fletcher has resigned as Technical Director, Sam Tour & Co., Inc. New York City, to accept the position as Director of Research for the American Society of Tool Engineers Research Fund.

Omar J. Glantz, formerly with the U. S. Bureau of Reclamation, Denver, Colo., is now Plant Engineer, Penn-Dixie Cement Corp., Perry, Ga.

George W. Gregg has been promoted to Vice-President in Charge of Sales Service, Advance Solvents and Chemical Corp., New York City.

Lester C. Hawk has retired as Research Director, Penn-Dixie Cement Corp., Nazareth, Pa.

Alfred M. Heald has been named Director of Research and Development at Hollingsworth & Whitney Co., Waterville, Me. He was formerly associated with the Scott Paper Co., Chester, Pa.

George F. Herrmann, formerly with the Ronson Art Metal Works, Inc., Newark, N. J., is now Chief Chemist, S. W. Farber Co., The Bronx, N. Y.

E. R. Hollinger has accepted a position as Director, Furniture Finishes Division, Bradley Paint Co., Los Angeles, Calif. He was previously associated with The Sherwin-Williams Co., of the same city, as Laboratory Director.

Thomas H. Jeffers has been appointed Assistant General Manager of the Anaheim, Calif., Division of Robertshaw-Fulton Controls Co. He also has been elected an Assistant Vice-President of the company. He was formerly Chief Engineer at Anaheim.

William C. Jenner, until recently with the Reliance Electric and Engineering Co., Cleveland, Ohio, has joined Houghton Laboratories, Inc., Olean, N. Y., as Chief Electrical Engineer. Mr. Jenner is well known throughout the electrical industry,

(*Continued on page 74*)

(*Continued from page 72*)
particularly for his work with insulating materials.

J. R. Keith has been appointed Assistant General Manager of the Refining Division of California Texas Oil Co., Ltd., with headquarters in New York. He has been on refining, research, and administrative assignments since joining The Texas Co. in 1929 and transferring to Caltex in 1937.

William Gus Koulas, formerly Project Engineer, Los Alamos Project, University of New Mexico, Albuquerque, N. M., is now associated with Black & Veatch, Kansas City, Mo., as Materials Engineer.

A. A. Leschen has retired as Vice-President in Charge of Production, Leschen Wire Rope Division, The Watson-Stillman Co., Inc., St. Louis, Mo.

Kenneth G. Mackenzie has retired as Assistant to the Vice-President in Charge of the Refining Department of The Texas Co., New York City, after more than 42 years with the company. He has opened offices as a petroleum consultant in Westport, Conn. Widely known in oil industry and chemistry circles through his outstanding work in organizing and directing continuous efforts to standardize testing procedures and criteria, he has always been greatly interested in closer cooperation between the petroleum and automotive industries.

A member of ASTM since 1912, and a Past-President of the Society, Mr. Mackenzie has been very active in both administrative and technical phases of ASTM activities and is at present one of the Society's representatives on the ASA Standards Council. Participating intensively for the past forty years in the deliberations of Committee D-2 on Petroleum Products and Lubricants, he served for eight years as Secretary, and for a like period as Vice-Chairman of that group. He has been especially active also in technical groups of the American Petroleum Institute, Society of Automotive Engineers, American Standards Assn., and the American Chemical Society. Mr. Mackenzie plans to continue many of his activities in the industry and many of his committee memberships.

A. R. Matthis has retired as Director, Société Anonyme Constructions Electriques de Charleroi, Marcinelle, Belgium. Professor Matthis has been an ASTM affiliate since 1922.

The New Jersey Zinc Sales Co., New York City, announces appointment of **G. F. A. Stutz** as Manager of Technical Service, succeeding **Bruce R. Silver,** who has become Technical Assistant to the Vice-President.

Fred W. Noechel, formerly Research Director, Goodall-Sanford, Inc., Sanford, Me., has accepted position as Head of the Textile Fibers Application Laboratory, National Aniline Division, Allied Chemical and Dye Corp., Hopewell, Va.

Emil Ott, Director of Research, Hercules Powder Co., Wilmington, Del., has been elected to the Council of Société de Chimie Industrielle of France.

H. A. Persyn has been appointed Superintendent of the Fine Chemicals plant of Reilly Tar and Chemical Corp., Indianapolis, Ind.

Fred S. Reagel, formerly with Marquette Cement Manufacturing Co., Chicago, Ill., is now Manager, General Research Laboratory, Des Moines, Iowa.

Lemuel V. Reese, previously associated with Fergusson, Wild, & Reese, Inc., Philadelphia, Pa., is now Manager, Metals and Ores Dept., M. Golodetz & Co., New York City.

N. Rowbotham recently retired as Divisional Director, The Bristol Aeroplane Co., Ltd., Bristol, England.

Raymond B. Seymour, Executive Vice-President and Member of Board, Atlas Mineral Products Co., Mertztown, Pa., has been named President of the company. **George L. Wirtz,** former President, is now Board Chairman.

William C. Shirley, until recently with the U. S. Reduction Co., East Chicago, Ind., as Chief Metallurgist, has accepted appointment as Vice-President and General Manager, Wabash Smelting Co., Wabash, Ind.

Charles R. Southwell, formerly Materials Engineer, Municipal Engineering Div., The Panama Canal, Rodman, Canal Zone, is now with the International Boundary and Water Commission, Del Rio, Tex., in a similar capacity.

William J. Stewart has been named Chief, Protective Coatings Laboratory, Nuodex Products Co., Inc., Elizabeth, N. J. He was formerly with the Sun Chemical Co.

A. M. Tenney, previously of The A. M. Tenney Associates, Inc., is now Vice-President and Director, Eastman Chemical Products, Inc., New York City.

Don S. Urquhart has accepted position as Sales Manager, Michigan Powdered Metal Products Co., Northville, Mich. He was formerly associated with Ferro Powdered Metals, Inc., of Salem, Ind.

Bernard A. Vallerga, until recently on the faculty of the University of California, Department of Civil Engineering, Berkeley, Calif., is now on the Staff of The Asphalt Institute, San Francisco, Calif., in the capacity of Managing Engineer.

W. M. Weddell, formerly Laboratory Group Leader, has been named Assistant Director of Central Laboratory of Dow Chemical., at Freeport, Tex.

Leslie C. Whitney has been promoted to Manager of Development Engineering, Wire and Cable Division, Copperweld Steel Co., Glassport, Pa. Mr. Whitney has served Copperweld since 1930 as Chief Metallurgist.

Reed Williams, formerly with The Johnson Rubber Co., Middlefield, Ohio, is now Works Manager, General Tire and Rubber Co., Wabash Plant, Wabash, Ind.

Morton O. Withey, Emeritus Dean of the University of Wisconsin College of Engineering, Madison, Wis, has been awarded the Citation of Merit of the Wisconsin Utilities Assn. for his outstanding service to the state, the university, and the engineering profession for almost half a century. Professor Withey is a long time ASTM member, a Past-Director, and active participant in the technical work of the Society.

Bureau of Standards Notes...

William G. Brombacher, Chief of the Mechanical Instruments Section of the Bureau, has retired after 35 years of service. Dr. Brombacher is one of the country's leading authorities on mechanical instruments, especially in the fields of pressure and humidity measurements, aeronautical instruments, and airborne oxygen equipment. During his career at the Bureau, he has made many contributions to its research program in mechanical instruments. This work has centered around the problem of refining and developing more accurate standards of pressure and humidity and related physical quantitities. Under Dr. Brombacher's direction the Section has extended the range of precise pressure measurement up to 200,000 psi and down to 0.00001 psi. Significant advances also have been made in the accuracy of humidity measurement, in various aeronautical instruments, and in the development of specialized oxygen equipment. Dr. Brombacher is a Past-President of the Instrument Society of America. Recently he completed a term as Chairman of the Instrument and Regulation Division of The American Society of Mechanical Engineers. As a member of the contest board of the National Aeronautic Association he has been responsible for certification of all barograph records made on world record aircraft and balloon flights.

G. B. Schubauer, formerly Chief of the Aerodynamics Section of the Bureau, has been appointed Chief of the new Fluid Mechanics Section which will cover work formerly carried out in the Aerodynamics and Hydraulics Sections. Dr. Schubauer is internationaly known for his research in the field of aerodynamics. He has developed hot-wire instruments of improved reliability and ruggedness, and succeeded in making measurements at a Mach number of 1.7. He developed a method of measuring turbulence based on thermal diffusion. His boundary layer researches include studies of the development of laminar and turbulent layers under the influence of a pressure gradient, causes of boundary layer separation, and characteristics of turbulence in boundary layers. Dr. Schubauer has been associated with the Bureau since 1929. He is a holder of the Sylvanus Albert Reed Award of the Institute of the Aeronautical Sciences. He has also received the Award for Scientific Achievement from the Washington Academy of Sciences.

Kodak reports to laboratories on:

identifying multicarbide phases by color photomicrography... making pH indicators easier to use... how to find out more about cellulose acetate sheeting

Metallography in color

Meet Mr. Foster. Charles S. Foster is our ace photomicrographer. Charlie's function with us is to dole out individualized advice on how most expeditiously to get where you want to go with a photomicrographic or metallographic undertaking. Being the kind of chap he is, Charlie's advice is likely to be highly personalized.

A year or two ago the chief metallographer in the Powder Metals Research Department at Firth Sterling Inc. in Pittsburgh thought he would ask Mr. Foster for a little help on the problem of identifying constituents and phases in multicarbide mixtures through photomicrography in color. Worked out fine. Recently that hard-boiled publication, *Steel*, carried a short illustrated article on the results. It may turn out to be something of a landmark in metallography. Time will tell.

The technique is heat-tinting at 900 F for 5 minutes after careful polishing and electrolytic etching in 5% sodium carbonate. The various phases assume characteristic colors: grey for tungsten carbide grains, yellow for tantalum carbide, tan for the solution areas of tungsten carbide plus titanium carbide, deep purple for the eta phase formed by carbon deficiency, blue for the cobalt matrix, and so on. Though Mr. Foster is no metallurgist, he did prove helpful on the important matters of illumination and filtering to record these color nuances reproducibly on *Kodak Ektachrome Film, Daylight Type.*

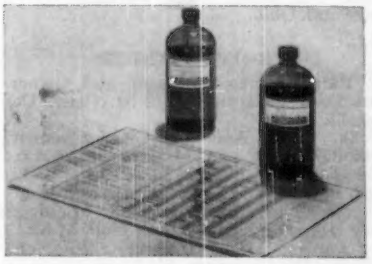
Bulking large in making the project practical was the fact that this film can be processed on the spot to judge the results.

Perhaps life is not really that simple, but we like to think that in superior creep properties, better service in jet engine blades, etc., Firth Sterling products are now or soon will be reflecting the knowledge gained through heat-tinting.

Mr. Foster will be most happy to send you a reprint of the Steel *article if you want to see color reproductions of Firth Sterling's heat-tinted carbides at 1500 diameters. Also, if you have problems of your own in photography through the microscope, don't hesitate to write him about them. His address: Eastman Kodak Company, Industrial Photographic Division, Rochester 4, N. Y.*

Indicator solutions

In the more orderly laboratories, it hangs on the wall; in others, you have to rummage for it under somebody's desk blotter. Ubiquitous on the scientific scene it is, though—the famous Eastman pH Indicator Chart with its array of bars that tell at a glance which of some 50-odd Eastman Organic Chemicals changes from what color to what other color over what pH range. The indicators themselves we have hitherto offered in dry form only—water or alcohol to dissolve them in is plentiful.

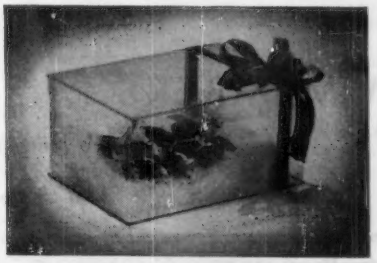


Now we have taken a second look at this policy, from the viewpoint of the business manager who knows that such laboratory drudgery as making up indicator solutions is still an expensive proposition. As a result, we report that nearly all the Eastman Indicators are now available as solutions in 500-cc bottles, with solvent, concentration, and pH range stated on the label. We continue to sell the indicators undissolved also.

Direct your inquiries and orders for Eastman pH Indicator Solutions to Distillation Products Industries, Eastman Organic Chemicals Department, Rochester 3, N. Y. (Division of Eastman Kodak Company). Write to the same address if the Eastman Indicator Chart is still not quite ubiquitous enough for your convenience. (It's free.)

Kodapak Sheet

A man in the business of manufacturing, let us say orchid boxes, can perhaps be forgiven for not thinking in terms of modulus of elasticity. We, who make for him the *Kodapak Sheet* out of which he fabricates his boxes, are in the business



of selling plasticized cellulose esters in a variety of cast sheet and extruded sheet forms. Since they find use in many technologies even more complex than the manufacture of orchid boxes, we have just put out a newly revised pamphlet in which we tabulate not only the moduli of elasticity of the various Kodapak Sheets but a great many other of their mechanical, optical, thermal, chemical, and electrical properties. The gist of it is that Kodapak Sheet, which may be readily formed by means of heat and pressure, cemented, or high-frequency sealed, is quite a versatile material.

You can obtain a copy of "Properties of Kodapak Sheet" by writing Eastman Kodak Company, Cellulose Products Division, Rochester 4, N. Y.

This is one of a series of reports on the many products and services with which the Eastman Kodak Company and its divisions are ... *serving laboratories everywhere*

Kodak
TRADE-MARK

DEATHS...

Arthur Ludlow Clayden, retired Manager of the Automotive Laboratory, Chemical and Engineering Division, Research and Development Department, Sun Oil Co., Marcus Hook, Pa., died February 23, 1954, in Halifax Hospital, Daytona Beach, Fla., at the age of 71. (Residence, Swarthmore, Pa.) Born in Bath, England, Mr. Clayden studied mechanical and electrical engineering at Bristol University. After operating a garage and repair shop, he became associated with the Daimler Motor Co. In 1910 he was named editor of the *Automobile Engineer* in London, and for the next eight years was affiliated with various trade papers. Prior to joining Sun Oil Co. as Chief Automotive Engineer in 1922 he served as general consultant for the United States Cartridge Co., Lowell, Mass. He was appointed Manager of Sun Oil's Automotive Laboratory in 1948, and retired from the post last July. Mr. Clayden had been a member of ASTM since 1924, serving on many of the technical committees, his activities being concentrated in Committees D-1 on Paint, Varnish, Lacquer, and Related Products, and D-2 on Petroleum Products and Lubricants, where he had headed many of the subgroups. He was also affiliated with the Society of Automotive Engineers, serving as Vice-President of its Fuels and Lubricants Section, and was a member of the Coordinating Research Council.

Helmut Heydegger, Instrument Maker, Standard Hydrometer Co., Inc., Glendale, N. Y. (July 10, 1953). Member since 1948.

William P. McGervey, President, Hanford Foundary Co., San Bernardino Calif. (November 14, 1953). Member since 1952.

N. F. S. Russell, Chairman of the Board of the United States Pipe & Foundry Co., Burlington, N. J., died February 24, 1954, at his home in Riverbank, N. J., as he was preparing to leave for his office. He was 74. He had been associated with his company since 1910, having been elected to the presidency in 1923 and serving in that post 25 years until he was named Board Chairman. He was a member of many technical and professional organizations and was a trustee of Colgate University and Jefferson Medical College. In ASTM he had represented the American Foundrymen's Assn. for many years on Committee A-3 on Cast Iron; also had been active on the ASA Sectional Committee on Specifications for Cast-Iron Pipe and Fittings.

Percival M. Sax, retired Civil and Consulting Engineer, died February 23, 1954, at his home, 6429 Drexel Road, Philadelphia, Pa., at the age of 83. A native of Nashville, Tenn., Mr. Sax was graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in 1890. He retired two years ago. He had designed the structural portion of the Philadelphia Museum of Art and Free Library, also the buildings of Duke University, Durham, N. C. Mr. Sax was a life trustee of Rensselaer Institute and a member of a number of engineering societies. He had been affiliated with ASTM for 18 years.

David Segal, Sales and Development Engineer, Eberbach Corp., Ann Arbor, Mich. (November 18, 1953). Member since 1938.

NEW MEMBERS...

The following 81 members were elected from January 22, 1954 to February 26, 1954, making the total membership 7572. . . . . Welcome to ASTM

Note—Names are arranged alphabetically—company members first then individuals

CHICAGO DISTRICT

Bellinger, Thomas P., Metallurgical and Materials Engineer, R. B. M. Division, Essex Wire Corp., Logansport, Ind.

Cellusuede Products, Inc., Harry Anaszewicz, Superintendent, 500 N. Madison St., Rockford, Ill.

Cherepow, Frederic H., Supervisor, Technical Service Lab., Marathon Corp., Menasha, Wis.

Herrick, John A., Metallographer, H. M. Harper Co., 8200 N. Lehigh Ave., Morton Grove, Ill. For mail: 3505 Meadow Lane, Glenview, Ill.

Indiana Technical College, Eugene Montoya, Jr., Administrative Engineer, 225 E. Washington Blvd., Fort Wayne, Ind.

Kinney, Edwin E., Chief Engineer, Engineering and Research, Outdoor Advertising Association of America, Inc., 24 W. Erie St., Chicago 13, Ill.

Osri, Stanley M., Chief, Process Engineering Section, Krafts Foods Co., 923 Waukegan Rd., Glenview, Ill.

Padgett, Rose, Professor, Textiles and Research Dept., School of Home Economics, Purdue University, West Lafayette, Ind.

Pinsof, Meyer, Assistant to Vice-President, SiPi Metals Corp., 1720 Elston Ave., Chicago 22, Ill. For mail: 751 Sherman Ave., Evanston, Ill.

Schwaner, Robert M., Wood Technologist, Hardwood Products Corp., 164 Lake St., Neenah, Wis.

CLEVELAND DISTRICT

Dyble, E., Chief Metallurgist, Cleveland Diesel Engine Division, 2160 W. 106th St., Cleveland 11, Ohio.

Shidemantle, Hal W., Manager, Materials and Processes, Engineering Dept., Jack & Heintz, Inc., 17600 Broadway, Cleveland, Ohio.

Stamps, Joseph L., Draftsman, Babcock & Wilcox Co., 118 E. St. Clair, Cleveland, Ohio. For mail: 9296 Parmelee Ave., Cleveland, Ohio. [J]*

DETROIT DISTRICT

Code, Ralph James, Manager and Owner, Unit Testing Service, 2142 St. Clair, Detroit 14, Mich.

Motycak, C. J., Assistant Chief Chemist, Detroit Gasket and Manufacturing Co., 12640 Burt Rd., Detroit 23, Mich.

Pocock, Bryant W., Chemical Research Engineer, Head of Isotope Section, Michigan State Highway Dept., 3 Olds Hall, M.S.C., East Lansing Mich. For mail: 810 Sunset Lane, East Lansing, Mich.

NEW ENGLAND DISTRICT

Brown Co., R. A. Webber, Administrator, Research and Development Dept., 650 Main St., Berlin, N. H.

Evans, Arthur W., Quality Control Manager, The Electro-Motive Manufacturing Co., Inc., South Park and John Sts., Willimantic, Conn.

Glencross, Richard, Metallurgist, Hersey Manufacturing Co., 381 E St., South Boston, Mass.

Lichman, Jack, General Manager, American Monomer Corp., 511 Lancaster St., Leominster, Mass.

Norwich, City of, Harold M. Walz, Director of Public Works, City Hall, Norwich, Conn.

NEW YORK DISTRICT

Adkinson, Ellsworth, Quality Control Manager, Rheem Manufacturing Co., Route 25, Linden, N. J. For mail: 69 Willow Rd., Metuchen, N. J.

Baker, Charles B., President, Universal Atlas Cement Co., 100 Park Ave., New York 17, N. Y.

Havens, William Westerfield, Specification Writer, Eggers & Higgins, 100 E. Forty-second St., New York 17, N. Y.

Higgins, Max B., Professional Engineer, Newfield Ave., R.R.3, Stamford, Conn.

Kassner and Co., John J., John J. Kassner, Partner, 111 Broadway, New York 6, N. Y.

Kettner, Albert E., Supervisor, Engineering, Magnetic Measurements and Standardization Services, General Engineering Lab., General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Oatley, Henry B., Consultant, 33 Arleigh Rd., Great Neck, N. Y.

Preston, John, Assistant Project Engineer, Curtiss-Wright Corp., Wright Aeronautical Div., Wood-Ridge, N. J.

Schapiro, Jerome B., Chemical Engineer-in-charge, Dixo Co., Garfield, N. J. For mail: 372 Mt. Prospect Ave., Newark 4, N. J. [J]*

Stainless Welded Products, Inc., H. C. Schanck, Jr., Chief Engineer, 251 Cornelison Ave., Box 406, Jersey City, N. J.

NORTHERN CALIFORNIA DISTRICT

Kellenberg, H., Consulting Engineer, Box 608, Madera, Calif.

Snell, Roy J., Manager, Engineering Services, National Motor Bearing Co., Inc., Redwood City, Calif.

OHIO VALLEY DISTRICT

Reinmuller, Ernest, Research, Hobart Brothers Co., Hobart Square, Troy, Ohio. For mail: 22 E. Franklin St., Troy, Ohio. [J]*

Strain, R. M., Chemical Control Administrator, Joseph E. Seagram and Sons, Inc., Seventh Street Rd., Louisville. Ky.

PHILADELPHIA DISTRICT

Clifford, Earl R., Jr., Physicist, Dixie Cup Co., Twenty-fourth and Dixie Ave., Easton, Pa.

Dotter, Edwin E., Assistant General Superintendent, The General Crushed Stone Co., Drake Bldg., Easton, Pa.

Harrison, H. Perry L., Secretary, Charles F. Kellom and Co., Inc., PRR at Ashburner St., Philadelphia 36, Pa.

Hooper, William H., Jr., Control Engineer, Rubberset Co., Box 97, Salisbury, Md.

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Johnson, Carl E., Chief Engineer, Scaife Co., Oakmont, Pa.
Martin, J. Paul, Materials Engineer, General Crushed Stone Co., Drake Bldg., Easton Pa.
Nelson, T. W., Director, Research and Development Dept., Socony-Vacuum Laboratories, Paulsboro, N. J.
Perlman, Sidney H., General Manager and Chief Engineer, Electric Hotpack Co., Inc., Cottman and Melrose Sts., Philadelphia 35, Pa.
Peters, H. F., Manager, Technical Service, Lukens Steel Co., Coatesville, Pa.

PITTSBURGH DISTRICT

Baldwin, James E., Chief Specification Metallurgist, Homestead Works, United States Steel Corp., Munhall, Pa. For mail: 1005 Sherwood Rd., Pittsburgh 21, Pa.
Elliott Co., J. A. Cameron, Chief Metallurgist, North Fourth St., Jeannette, Pa.
Johnson, Roger L., Engineer, Copperweld Steel Co., Glassport, Pa.
Larabee, C. P., Research and Development Lab., United States Steel Corp., Vandergrift, Pa.
Rodriguez, Jose, Consulting Chemist, Corporacion Carbonera Colombiana, Cali, Colombia, S. A. For mail: 124 Carnegie Place, Pittsburgh 8, Pa.
Stadterman, Charles R., Research Engineer, Pittsburgh Plate Glass Co., Research Labs., Creighton, Pa. For mail: 23 Argonne Dr., New Kensington, Pa. [J]*

ST. LOUIS DISTRICT

Prehn, William H., Chief Inspector, Jackes-Evans Manufacturing Co., 4427 Geraldine, St. Louis, Mo.
Vernon, D. W., Vice-President and General Manager, Leschen Wire Rope Division, The Watson-Stillman Co., 5909 Kennerly Ave., St. Louis 12, Mo.
Wells, T. M., Chief Test Engineer, The Vendo Co., 7400 E. Twelfth St., Kansas City 3, Mo.

SOUTHERN CALIFORNIA DISTRICT

Drake, John F., Kennard & Drake, 3364 E. Fourteenth St., Los Angeles 23, Calif.
Price, Floyd L., Assistant Chief Chemist, W. J. Voit Rubber Corp., 1600 E. Twenty-fifth St., Los Angeles 11, Calif.
Rollins, Thomas J., Manager, Keldon Research Corp., Box 2555, Terminal Annex, Los Angeles 54, Calif.
Steger, A. K., President, Hanford Foundry Co., Box 192, San Bernardino, Calif.

WASHINGTON (D.C.) DISTRICT

Kientz, Oscar R., Plant Manager, Plymouth Cordage Co., 113 W. Bank St., Petersburg, Va.
Lonie, Mansfield, Project Manager, Apparel and Textile Standards, Commodity Standards Div., Office of Technical Services, 4519 Main Commerce Bldg., Washington 25, D. C.
Schilkowsky, Carl, Manager Control Dept., Sidney Blumenthal and Co., Inc., Caromount Div., Rocky Mount, N. C.
Shuford Mills, Inc., Ed Weitzel, Manager, Research and Development, Highland Ave., and Fifteenth St., N. E., Hickory, N. C.
Stanley, Robert L., Educational Director, Diesel Engine Manufacturers Assn., 1 N. LaSalle St., Chicago 2, Ill. For mail: 214 Midvale St., Falls Church, Va.

WESTERN NEW YORK-ONTARIO DISTRICT

Hamilton, Ward L., Manager, Testing and Consumer Engineering, The Ritter Co., Inc., 400 West Ave., Rochester 3, N. Y.
Hollis, J. F., Supervisor, Control Lab., E. I. du Pont de Nemours and Co., Inc., Niagara Falls, N. Y.
King, J. A., Metallurgist, Thompson Products, Ltd., St. Catharines, Ont., Canada.
Kuhn, Arthur W., Technical Supervisor, The American Brass Co., 70 Sayre St., Buffalo 5, N. Y.

UNITED STATES AND POSSESSIONS

Dykes, Hiram Waite Hoyt, Chemist, Southern Laboratories, Inc., 957 Spring Hill Ave., Mobile, Ala. For mail: 116 S. Georgia Ave., Mobile, Ala.
Hailes, Gardner M., Quality Control Manager, Avondale Mills, Sylacauga, Ala.
Stuff, Paul H., Metallurgist, Ross-Meehan Foundries, 1601 Carter St., Chattanooga 1, Tenn.
Wickett, John Allan, Foundry Engineer, U. S. Pipe and Foundry Co., 3300 First Ave. N., Birmingham, Ala.

OTHER THAN U. S. POSSESSIONS

British Columbia Electric Co., C. G. Killam, Chief Chemist, 425 Carrall St., Vancouver 4, B.C., Canada.
Hooker, S. G., Chief Engineer, The Bristol Aeroplane Co., Ltd., Filton House, Bristol, England.
Jewett, George S., Manager, Sales Div., Falconbridge Nickel Mines, Ltd., 44 King St., W., Toronto, Ont., Canada.
Livingston, Donald A., Assistant Manager, ESCO, Ltd., 146 E. First Ave., Vancouver 10, B. C., Canada. For mail: 6876 Adera St., Vancouver 14, B. C.
Materialprüfungsamt Berlin-Dahlem, Max Pfender, President, Unter den Eichen 86–87, Berlin-Dahlem, Western Sector, Germany.
Mostafa, Mostafa Khalil K., Lecturer in Civil Engineering, Faculty of Engineering, Ibrahim University, Abbasia, Cairo, Egypt For mail: 18, El Saraya St., Agouza, Cairo, Egypt.
Sanderson, N. K., Sales Manager, Fabric Div., Drummondville Cotton Co., Ltd., 1950 Sherbrooke St., W., Montreal 25, P. Q., Canada.
Smith, Charles E., Research Metallurgist, Mond Nickel Co., Ltd., D and R Laboratory, Wiggin St., Birmingham, England. For mail: 161 Cherry Orchard Rd., Handsworth Wood, Birmingham 20, England.
Timmis, L B, Librarian, Armament Research Establishment, Fort Halstead, Sevenoaks, Kent, England.
Vandecapelle, Herni P. C., Directeur, Institut National du Verre, 24 rue Bourlet, Charleroi, Belgium.
Vega, Clements Alonso, Chief of Laboratory, C. A. Venezolana de Cementos, Apartado 531, Maracaibo, Venezuela.

* J denotes Junior members.

NEWS NOTES ON

Laboratory Supplies and Testing Equipment

Please mention ASTM BULLETIN when writing to suppliers

CATALOGS AND LITERATURE

Creep Testing Machines—Five types of creep testing machines for standard sized metal specimens are presented in a new twelve-page bulletin by Baldwin-Lima-Hamilton Corp. The lever arm and screw type creep machines, Microformer type and new SR-4 type automatic relaxation machines, and a constant strain rate machine are included in *Bulletin 4208* with pictures, dimensional diagrams, and specifications.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Scientific Equipment—A recent issue of the *Burrell Announcer* contains several articles dealing with scientific equipment. A featured article outlines early history, and research and development activities of Corning Glass Works. The magazine lists ultra-speed electro-analyzers, centrifuges, operation-time recorders, micropipets, carbotranes, viscosimeters, hot plates, and other scientific apparatus.

Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Electronics Digital Computer—A general purpose mathematical machine that is adaptable to almost any problem reducible to numerical terms has been announced by Consolidated Engineering Corp. The Model 203 Electronic Digital Computer employs an easily understood, binary-coded decimal system utilizing a combination series—parallel operation. A magnetic drum rotating at 3600 rpm, with a capacity of 4080 words of 10 decimal digits each, serves as the computer's memory unit. *Bulletin CEC-3100* gives further details.

Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.

Laboratory Instrumentation—A new issue of *The Laboratory*, Vol. 23, No. 3, published by Fisher Scientific Co., features a seven-page report on the researchers in the worldwide photographic industry. The picture-story deals with laboratory techniques in chemistry and research practices involving the use of electron microscopes, mass spectrographs and quantum theory. Equipment reported in the issue includes: Fisher-Johns Meeting Point Apparatus, new laboratory furniture, a revised wall chart of gravity-temperature correction tables with the new ASTM values, and a new line of Fisher/TAG ASTM Aniline Point Thermometers.

Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Intermediate Quartz Spectrograph—A new bulletin describing the L 251-15 Intermediate Two Lens Quartz Spectrograph has been published by the Gaertner Scientific Corp. The instrument is designed for work with emission and absorption spectra and can be used for production control work with nonferrous alloys. *Bulletin 189-53* describes the spectrograph in detail.

The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.

Laboratory Sinks—*Bulletin L 53* describes and illustrates the new line of laboratory sinks available from General Ceramics and Steatite Corp. Bearing the name Perma Gloss, these sinks are made from Zircon Porcelain. One outstanding characteristic claimed for Perma Gloss Sinks is high thermal shock resistance. The six-page bulletin contains numbered drawings, size number, type

(*Continued on page 80*)

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outlet, and weight. Write for detailed information.

General Ceramics and Steatite Corp., Chemical Equipment Div., Keasbey, N. J.

Scintillation Counters—It has been announced by Nuclear Research and Development, Inc., that several new attachments have been developed for the scintillation counter series known as the Radimax counters. The additions include the combination wide angle and collimated head (SC-44), well type counter (SC-12), miniature basic unit series (SC-33), and an alpha counter. In addition, two new lead shields are described.

Nuclear Research and Development, Inc., 6425 Etzel Ave., St. Louis 14, Mo.

Electronic Balancing Machines—The Electodyne, a new principle for automatically measuring the amount and indicating the angular location of unbalance by means of electronics, is described in *Bulletin 49* just released by the Tinius Olsen Testing Machine Co. In addition, the bulletin describes features of the complete line of Olsen Electodyne dynamic and static balancing machines, including the horizontal and vertical models as well as the automatic crankshaft balancer. Copies are available upon request.

Tinius Olsen Testing Machine Co., 2020 Easton Road, Willow Grove, Pa.

Automatic Testing Controllers—*Bulletin 48* just released by the Tinius Olsen Testing Machine Co. features a new line of electronic controllers for automatic testing production and research testing program. Controllers for Automatic Production Testing, Proof Testing and Yield Strength by the extension under load method are described, as well as Stress (Load) Cycling, Strain (Unit Deformation) Cycling, and Crosshead Cycling. Copies available upon request.

Tinius Olsen Testing Machine Co., 2020 Easton Rd., Willow Grove, Pa.

Laboratory Furniture—A 24-page catalog covering the newest developments in laboratory furniture and utility equipment items has been published by Schaar and Co. Illustrated and described in Catalog AK-54 are sink units, cupboard, and drawer units, plus laboratory chairs, stools, desks, shelving units, numerous types of storage cabinets, carts, ladders, and many other items.

Schaar and Co., 754 W. Lexington St., Chicago 7, Ill.

INSTRUMENT NOTES

Electrical Calibrating Instruments—New universal electrical calibrating instruments with wide capacity ranges for calibrating and proving testing machines and other measuring equipment under loads in both tension and compression, are announced by Baldwin-Lima-Hamilton Corp. The new SR-4 calibration equipment meets ASTM Specifications E 75, Tentative Methods of Verification of Calibration Devices for Verifying Testing chines.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Creep Testing Machine—A new automatic, high-temperature relaxation creep testing machine of 10,000-lb capacity, incorporating an SR-4 load cell as an electrical pick-up for load measurement, is announced by Baldwin-Lima-Hamilton Corp. The high-capacity SR-4 type machine offers the advantage of additional lower load ranges with a single pick-up device. Accuracy is within 1 per cent of reading or ¼ per cent of full scale, whichever is greater.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Vacuum Tube Voltmeter—Development of a vacuum tube voltmeter designed to complement the Shasta line of miniature test instruments has been announced by the Shasta Div. of Beckman Instruments, Inc. Model 201 fulfills the function of a general purpose laboratory or service vacuum tube voltmeter for the measurement of dc or ac voltages, and resistances. Dc voltages are covered in seven full scale ranges of 1.5 to 1500 v at an impedance of 11 megohms. Ac ranges are calibrated both in RMS values of sine waves (1.5 to 1500 v, full scale) and peak-to-peak values of 4 to 4000 v.

Beckman Instruments, Inc., Shasta Div., P. O. Box 296, Sta. A, Richmond, Calif.

New Polishing Desk with Matching Storage Cabinet—For the production of specimens in the metallurgical laboratory, Buehler Ltd. announces the new Buehler cabinet type polishing table with compan-

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ion storage cabinets. The two unit polishing table has Formica top, and is approximately 60 in. long, 27 in. deep, and 30 in. high to table top. It includes two 12-in. swing spouts, a large 8-in. diameter wash bowl with drain, plumbing and wiring.

Buehler Ltd., 2120 Greenwood Ave., Evanston, Ill.

Torsion Spring Tester—A Universal Tester for checking loads and deflections of torsion, double torsion, spiral, clock, and power springs has been announced by The Carlson Co. Although useful for general purpose testing, it can be used for high quantity production testing of torque and angular travel at speeds of 300 to 600 tests per hour. The tester is guaranteed accurate within ¼ of 1 per cent.

The Carlson Co., 277 Broadway, New York 7, N. Y.

"Variac" Speed Controls—General Radio Co. has announced that power ratings for the "Variac" Motor Speed Controls now extend from $\frac{1}{15}$ to $1\frac{1}{2}$ hp. The five new models include the Type 1703-A—⅛ hp Control, Type 1704-A—1 hp Control, Type 1705-A—$1\frac{1}{2}$ hp control, Type 1701-AM—$\frac{1}{15}$ hp Control with single speed range, and the Type 1702-M—¾ hp Control with remote station push-button and speed control.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

Permeometer—A new model Permeometer for measuring the porosity or air permeability of materials too porous to be tested accurately or conveniently with a densometer is now available from the Industrial Div. of W. & L. E. Gurley. It is suitable for testing materials which give densometer readings of less than 10 sec per 100 cc air flow; measures air flow from less than one to about 400 cu ft of air per min, per square foot, at a pressure drop equal to 0.5 in. of water. Tests can be made rapidly, routine tests in less than 15 sec. The motor operates on direct current, or alternating current from 25 to 60 cycles, 115 v.

W. & L. E. Gurley, Industrial Div., Troy, N. Y.

Radiological Gas Analyzer—This new instrument designed by Shell Development Co. has been announced and will be manufactured by Hallikainen Instruments. The Radiological Gas Analyzer is adapted for continuous analysis of binary gas mixtures by measurement of ionization produced in the gas by beta radiation from a radioactive source. The radioactive source used is Strontium 90.

Hallikainen Instruments, 1341 Seventh St., Berkeley, Calif.

Megohm Meter—A Megohm Meter designed for high-speed testing of transformer winding, motor windings, cables, capacitors, and all other applications of insulation leakage in accordance with ASTM Method D 257[1] is now available from Industrial Instruments Inc. The Series L Megohm Meter features constant voltage within ± 0.1 per cent across test piece. A built-in voltmeter assures accurate settings. Accuracy of resistance bridge ± 1.0 per cent of full scale current.

Industrial Instruments, Inc., 89 Commerce Rd., Cedar Grove, N. J.

Master Precision Level—A new Master Precision Level, Number 59, having application in the metal-working industry—in machine shops, inspection departments, tool rooms, and millwright departments has been announced by The Lufkin Rule Co. This precision level gives extra accuracy: the ground and graduated vial is of 10 sec accuracy, with one division equaling 0.0005 in. per foot.

The Lufkin Rule Co., Saginaw, Mich.

Sulphur Dioxide Gas Detector—The "Sulphur Dioxide Gas Detector," recently announced by Mine Safety Appliances Co. is said to be an exceptionally accurate yet easy-to-use portable instrument for quickly determining SO_2 concentrations of 0 to 50 ppm in the atmosphere of a working area. The user squeezes the aspirator bulb three times for an adequate air sample, then reads the SO_2 concentration on a graduated scale on the detector tube. The reagent in the tester tube turns from blue to white, and the length of decolorization is directly proportional to the per cent of SO_2 in the sample. Details available upon request.

Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburch 8, Pa.

Foam Rubber Softness Tester.—The Pacific Transducer Corp. announces a hand tester for the measurement of hardness or resiliency of foam and sponge rubbers, as well as other soft elastomers. In

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[1] Tentative Methods of Test for Electrical Resistance of Insulating Materials (D 257 – 52 T) 1952 Book of ASTM Standards, Part 6, p. 1031.

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taking a measurement, the Model 302 S Pandux Foam (Sponge) Rubber Tester is placed on the material to be measured and pressed against the material so that the base is flush with material surface. This permits the indentor to give a direct reading on the scale of the dial.

The Pacific Transducer Corp., 11921 W. Pico Blvd., Los Angeles 64, Calif.

Slowness Tester—Available from the Paprex Co. is the Standard Laboratory Slowness Tester for measuring the slowness (freeness) of stock. The instrument offered by the company provides several features, it is said, including readings that check within 2 per cent, the ability to be set up and ready for work in 3 min, and 2 to 5 determinations every minute. It applies without chance to the widest variety of different stocks and different stock preparation procedures and brings them all to one recognized basis of comparison.

Paprex Co., Box 65, Needham 92, Mass.

Heat Treating Furnace—Temperature indication, control and permanent record, plus completely automatic time-temperature program control for full heating and cooling range are built into the all steel control panel of a new PERECO Model FG-430 general purpose heat treating furnace, according to officials of the Pereny Equipment Co. Accuracy of the measuring system is within ¼ of 1 per cent. Added features are the convenient external control setting, large calibrated indicating scale, and automatic chart rewind and tear-off mechanism.

Pereny Equipment Co., 893 Chambers Rd., Columbus 12, Ohio

Cobalt 60 Radiographic Equipment for Internal Exposures—Technical Operations, Inc., announces the design and production of the PES (Panoramic Exposure Shield) for use in Cobalt 60 radiography. It was developed to permit the safe handling of strong radioactive sources for three specific requirements: exposures in internal locations; radiography where electric power is not available; panoramic exposures. The PES is available in two models, No. 202, for safe handling of 2000 millicuries of Cobalt 60, and No. 402, for safe handling of 4000 millicuries of Cobalt 60 (equivalent, radiographically, to 6000 mg of radium).

Technical Operations, Inc., 6 Schouler Court, Arlington, Mass.

Low Temperature Chambers for Cold-Treating Metals—Tenney Engineering recently expanded its line of low-temperature "Sub-Arctic" chambers to include models for producing temperatures to −170 F. The new lower temperature units are equipped with special rotary compressors designed for use with latest Freon refrigerants. The "Sub-Arctic" is available with 1, 4, 6, 9, and 12 cu ft work spaces. Chambers in all five sizes are available for producing temperatures to −40, −80, −100, and −120 F. Further information from the company.

Tenney Engineering, Inc., Newark, 5, N. J.

Laboratory Magnet—A new, multipurpose laboratory electromagnet, the 6-in. Model V-4007, has been announced by Varian Associates. Field values claimed for this laboratory magnet include changeable pole caps for uniform or high field work, an adjustable gap that provides a gap range from ¼ to 6 in., and a dolly mount that gives complete mobility without loss of rigidity in operating positions. The magnet yoke angle can be easily changed to provide a variety of positions for working access. Complete data can be obtained by writing to Special Products Sales Dept.

Varian Associates, Palo Alto, Calif.

Lyophilizing Unit—A standard glass Lyophilizing Unit designed for quick drying and freezing of organic tissues is now available from Wakefield Industries, Inc. The apparatus is particularly useful in biological chemistry, organic chemistry, and medical laboratories. The standard Lyophilizing Unit has a capacity of 400 cc. For further information write Dept. PF-2.

Wakefield Industries, Inc., 5108 W. Grove St., Skokie, Ill.

INSTRUMENT COMPANY NEWS

Corning Glass Works, Corning, N. Y.—Appointment of William H. Tomb, Jr. as merchandising manager for the Technical Products Div. has been announced by Russell Brittingham, division manager. D. J. Lammon, former manager of appliance parts sales, becomes manager of specialty products sales, succeeding Mr. Tomb.

Fisher Scientific Co., Pittsburgh, Pa.—Aiken W. Fisher, president, recently an-

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nounced that construction has been started on a new plant of the Fisher Chemical Div. to be located on a nine-acre lot in Fair Lawn Industrial Park, N. J. The new plant, to be completed in the fall of 1954, will be "the largest plant in the United States designed exclusively for reagent-grade chemicals."

Frederick G. Keyes, Inc., Cambridge, Mass.—The change of corporate firm name of a well-known scientific apparatus manufacturer was announced recently by Alfred Bicknell, board chairman, Alfred Bicknell Associates, Inc. The firm will henceforth be known as Frederick G. Keyes, Inc. Mr. Bicknell stated that Dr. Keyes had been a partner, as well as the firm's director of research, since 1949.

Purdue University, Lafayette, Ind.—Completion of a $100,000 rocket research laboratory, the latest addition to extensive rocket and jet-propulsion research facilities built on the campus of Purdue University, was announced by officials of the university recently. Dr. M. J. Zucrow, director of the rocket laboratory, said the new facilities were specially designed for instruction in basic research activities. Built-in features include an array of measuring and recording instruments, which facilitate gathering and correlation of the vast amount of technical data uncovered daily.

Soiltest, Inc., Chicago, Ill.—M. D. Morris of New York City will be the Eastern Representative for the company. Acting in that capacity, for this Chicago manufacturer of soils and concrete testing apparatus, his office address will be 545 Fifth Ave., New York 17, N. Y.

Vanadium Corp. of America, New York, N. Y.—Research activities for the company are being concentrated in a new research center at Cambridge, Ohio. First unit of the expansive center is now open and provides 30,000 sq ft of metallurgical and chemical laboratories for the evaluation of metals and alloys. Scheduled for early completion is a second unit housing pilot plant facilities in which actual production tests of laboratory findings will be made.

Will Corp.. of Maryland, Baltimore, Md.—The new address of the company is 5–31 N. Haven St. The new quarters of this laboratory supply house provide greater storage space and facilities are available to assure prompt repair of laboratory instruments.

High-Speed Coin-Weighing Machine

A FULLY automatic machine for weighing coins rapidly has been developed at the National Bureau of Standards at the request of the Department of the Treasury. The NBS machine can weigh and sort 18,000 coins per hour with an accuracy of $\frac{1}{4}$ of 1 per cent in the weighing of 25-cent pieces and with even greater accuracy for the larger coins. This system has the advantages of high sensitivity, low susceptibility to seismic noise, and independence of other physical properties of the coin except diameter which, however, is held to extremely close tolerances in manufacture.